THIS WEEK'S National Petroleum NEWS

Index to Coming Meetings

Mid-Continent Oil & Gas Association, Texas division, San Angelo, Tex., Nov. 8.

American Petroleum Institute, Technical Committee on Prevention of Pollution, Chicago, Nov. 30.

American Petroleum Institute, Stevens Hotel, Chicago, Dec. 3, 4 and 5.

Nebraska Independent Oil Men's Association, Paxton Hotel, Omaha, Neb., Dec. 4, 5, 6.

Indiana Petroleum Association, Indianapolis, Dec. 5, 6.

Michigan Oil Men's Association, Statler Hotel, Detroit, March 19, 20, 21.

NATIONAL PETROLEUM NEWS

Vol. 21 No. 44

Published by

The National Petroleum Publishing Co.
1213 W. Third St., Cleveland, O.

Tel. CHerry 7672

Branch Offices:

Tulsa, 904 World Bldg., Tel. 3-7132.

New York, 342 Madison Ave., Tel. Vanderbilt 3951.

Houston, 2020 Gulf Bldg., Tel. Fairfax 6286.

Chicago, 35 E. Wacker Drive, Tel. State 4141.

Subscription rate $3.50 per year, U. S., Mexico and Canada: $5 Foreign countries. Current copies 10 cents; for back issues more than two months old 25 cents per copy.

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ON PAGE 80 is to be found the index to articles in the Special Engineering Section in this issue—pertaining to the producing, refining, natural gasoline manufacturing and distributing branches of the industry.

H. V. FOSTER, president of the Indian Territory Illuminating Oil Co. and of the Foster Petroleum Corp., has been a producing executive throughout almost the whole oil history of the Mid-Continent.

Even the name of the I. T. I. O., as it is usually called, denotes the historical background of the company which was organized before statehood and when kerosene still was the important product of petroleum.

Mr. Foster's father negotiated a blanket lease on the 1,500,000-acre Osage nation but died before it became effective in 1896. The Phoenix Oil Co., which drilled the first well in the Osage, and the Osage Oil Co. were merged to form the I. T. I. O. in 1902 and Mr. Foster became its president in May, 1903.

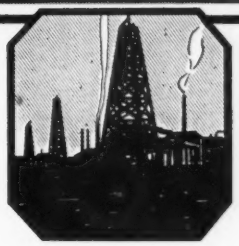
At that time about 30 wells had been drilled in the Osage and there was little development elsewhere in Oklahoma. Total production of the Osage in 1903 was 58,000 barrels.

The Osage lease was renewed in 1906 and expired finally in 1916. Since then the company has expanded into other fields, notably Seminole, where it has produced more than 30,000,000 barrels of oil since 1926, and Oklahoma City where it drilled the discovery well in 1928.

Mr. Foster is an engineer with a degree from University College of London, and additional training at Columbia University at New York. He is a banker as well as an oil producer.

NATIONAL PETROLEUM NEWS

Published at
1213 W. Third St.
Cleveland



Branch Offices
Tulsa, New York, Houston,
Chicago

Vol. 21 CLEVELAND, October 30 No. 44

Prize Winners Named in N.P.N. Field Men's Contest

CLEVELAND, Oct. 28

PRACTICAL suggestions on the use, in the drilling fields, of the long slip wire line drilling clamp, won first prize in the Field Men's Idea Contest staged by NATIONAL PETROLEUM NEWS in connection with the recent International Petroleum Exposition at Tulsa.

To J. E. Boxell, clean-out man in the Drumright, Okla., district for the Shaffer Oil & Refining Co., goes $200 in cash offered by NATIONAL PETROLEUM NEWS for the suggestion on new or improved equipment, to come out of study of exhibits at the Oil Exposition, which the judges, themselves experienced field men, considered as of greatest practical value.

The contest was open to all men employed in field work for any oil company, who attended the exposition. Fifteen cash prizes were offered for the best ideas on what was seen in the exhibits that could be put into use in the field man's own work to save money for his company.

Production superintendents and exhibitors of drilling and producing equipment at the Exposition were enthusiastic over the contest. The executives with the producing companies saw in it a valuable method to stimulate the interest with which their men studied the exhibits for ideas they could apply in their own work.

Exhibitors said it was likely that suggestions coming from the field men, the users of their equipment, would be of value to the manufacturers of such equipment.

It was originally planned to close the contest as soon as the Exposition ended. So many field men, however, asked for time to study over what they had seen there and then write up their ideas, that it was announced that entries would be received until Oct. 23.

Judges C. P. Dimit, general superintendent, Gypsy Oil Co., Tulsa; Charles Jacobsen, southern district superintendent, Barnsdall Oil Co., Tulsa; and John Power, staff writer on production methods for NATIONAL PETROLEUM NEWS at its Mid-Continent Bureau, made their final decisions Oct. 25.

Second prize of $100 was won by H. H. Haper, district superintendent for the Skelly Oil Co. at Oklahoma City.

His idea had to do with the chambered control head which makes it possible to get tools into or out of the hole against high oil or gas pressures.

Description of an improved "crummy," or tubing tong, took third prize, the money going to W. J. Cox, field foreman for the Gypsy Oil Co. at Depew, Okla. The amount of this prize was $50.

The Prize Winners

First Prize, $200—J. E. Boxell, Shaffer Oil & Refining Co., Drumright, Okla.

Second Prize, $100—H. H. Haper, Skelly Oil Co., Oklahoma City.

Third Prize, $50—W. J. Cox, Gypsy Oil Co., Depew, Okla.

Fourth Prizes, $25 each—L. B. Dodds, Mid-Continent Petroleum Corp., Sasakwa, Okla.; Hurley Smith, Sinclair Oil & Gas Co., Shamrock, Okla.; J. W. Stricklin, Carter Oil Co., Broken Arrow.

Fifth Prizes, $10 each—W. D. Lyles, Barnsdall Oil Co., Mankins, Texas; J. E. McCullum, Kewanee Oil & Gas Co., Mounds, Okla.; Orgle Cargill, Shaffer Oil & Refining Co., Shamrock; Joe H. Hinton, Barnsdall Oil Co., Bartlesville, Okla.; Watson Bettis, Gypsy Oil Co., Drumright, Okla.; J. E. Rogers, Skelly Oil Co., Iowa Park, Texas; W. C. Milam, Minnehoma Oil & Gas Co., Cleveland, Okla.; William Winesburg, Barnsdall Oil Co., Bristow, Okla.; T. J. Mitchell, Shaffer Oil & Refining Co., Shamrock; J. E. Drawbaugh, Shell Petroleum Corp., Avant, Okla.; W. H. Danforth, Shaffer Oil & Refining Co., Shamrock; J. W. Williams, Barnsdall Oil Co., Barnsdall, Okla.

While NATIONAL PETROLEUM NEWS had offered two prizes of $25 each for ideas considered fourth best, the judges decided that three entries had tied in the value of their suggestions and therefore, awarded three prizes in this class instead of two.

One was to Luke B. Dodds, lease foreman for the Mid-Continent Petroleum Corp., in the Sasakwa, Okla., district, for his ideas on the use of a device for finding quickly and accurately the leaks in a string of tubing.

One was to Hurley Smith, field man for the Sinclair Oil & Gas Co. at Shamrock, Okla., for his ideas on the use of a safety spider, consisting of a set of four slips operated by means of a four-foot handle.

The third was to J. W. Stricklin, a driller for the Carter Oil Co., living at Broken Arrow, Okla., for his suggestions concerning a new rotary bit which jets the fluid directly on the bottom of the hole.

In the fifth class of prizes, $10 was offered for each of ten suggestions. In two cases, two entries were made describing the same equipment and its use and, in these cases, a $10 prize was given to both entries. The prize winning ideas in this class were:

Use of an improved socket for fishing parted sucker rods, to W. D. Lyles, farm boss for the Barnsdall Oil Co. at Mankins, Texas.

Suggestions for automatic flowing of small wells by artificial means, to J. E. McCullum, district foreman for the Kewanee Oil & Gas Co., Mounds, Okla.

Description of a new type of improved shovel, submitted by Orgle Cargill, Shaffer Oil & Refining Co. roustabout at Shamrock, Okla.

An entry by Joe H. Hinton, chief clerk and assistant district superintendent, for the Barnsdall Oil Co. at Bartlesville, Okla., also describing the same type of shovel, was also awarded a prize in this class.

A $10 prize went to Watson Bettis, district superintendent for the Gypsy Oil Co. at Drumright, Okla., for his ideas on a counter-balance for beam pumping wells which is applied on the shaft where the calf wheel sprocket usually goes, and which is easily and quickly removed when it is necessary to work on the well.

A suggestion on the automatic idler and the use of endless belts won $10 prizes for J. E. Rogers, pumper for the Skelly Oil Co. at Iowa Park, Texas, and also for W. C. Milam, farm boss for the Minnehoma Oil & Gas Co. at Cleveland, Okla.

Description of a spiral standing valve tap which goes down through the settlings in a working barrel and pulls the standing valve which has mudded up won a $10 prize for William Winesburg, district superintendent for the Barnsdall Oil Co. at Bristow, Okla.

An idea on a circular wrench for screwing up parted sucker rods in the hole, the wrench having a high safety factor as well as being an efficient tool, won a prize for Thomas J. Mitchell, roustabout for the Shaffer Oil & Refining Co., at Shamrock.

J. E. Drawbaugh, employed by the Shell Petroleum Corp. at Avant, Okla., told of a new packing which should prove more satisfactory than what he had been using to pack the shafts of centrifugal circulating pumps and of a new improved way of cutting the packing which he had learned at the Exposition and won a $10 prize.

Use of a wrist pin hole reamer, hand operated, which makes it possible to ream out wrist pin holes that have become belled by the wobbling of loose pins, as described by W. H. Danforth, Shamrock district superintendent for the Shaffer Oil & Refining Co., won him a $10 prize.

AN IDEA for the use of a cleaning out attachment for a rod and tubing pulling machine, submitted by J. W. Williams, district superintendent for the Barnsdall Oil Co. at Barnsdall, Okla., won the last of the $10 prizes.

Selecting the prize winners was no easy task.

In awarding first prize to the long slip wire line clamp it was decided that this clamp made it possible to slip the drilling line through the clamps without burning them and without the usual danger of letting too much line feed through. In all fields there is still a lot of cable tool work, and it was the united opinion of the judges that the companies were not getting the service from the lines that the manufacturers were building into them. Wire line expense is a tremendous one, and the long slip clamp should go a long way toward increasing the service the operators and contractors get from their wire lines, and should result in a material saving throughout the oil country. The winning suggestion follows:

First Prize Winner

"The long slip wire line clamp is, in my opinion, a distinct improvement in the carrying on of all forms of cable tool work. In spite of orders, in spite of occasional trouble into which the practice has led them, all drillers will slip the line through the clamps instead of using the screw. It is not my place to blame them for this, but it is a fact that it is a common practice.

"This slipping the line through the clamp burns the line. It is fed through jerkily, and sometimes results in kinks being thrown in the line above the screw. Free line being slipped through the clamp can easily have the core damaged by the sudden pressure on the line as it passes through the clamp.

"The long slip clamp will not do away with the practice of slipping the line, but it makes it a harmless one. The drilling line can be fed through the clamp an inch at a time, with no ill effects on the line, and with no danger of the line getting away from the driller and letting out more than the driller had intended. The slips will not be drawn, either, as sometimes happens with the shorter models.

"The increased leverage which the long slip type of clamp provides makes it possible for the driller to control easily the amount of line that he is feeding through. The ability to slip the line an inch or so at a time with perfect assurance and safety makes this long slip type of clamp especially desirable for cleaning out and drilling in work, where a little too much hole can result in a lot too much water."

Of great importance in the area in which Second Prize Winner Haper is interested is the chambered, or "lubricating" type control head, which makes it possible to get the tools into or out of a high pressure gas or oil well without opening the well to atmospheric pressure. In selecting this as the second prize winner the judges felt that they were awarding a prize for an idea on a required article that will provide a tremendous saving of oil, or gas, and of the more important gas pressure by making it possible to work on wells in such areas as the Oklahoma City pool, where pressures and volumes are high.

The safety factor, difficult to evaluate in terms of dollars, also enters into the use of the head. Although

Exhibits Studied

Ideas which won prizes in NATIONAL PETROLEUM NEWS Field Men's Contest were secured from a study of the following exhibits at the International Petroleum Exposition, at Tulsa Oct. 5 to 12:

First Prize—Charles A. Butler Mfg. Co. and The Western Supply Co.

Second Prize—Oil Well Improvements Co.

Third Prize—The W. K. M. Co.

Fourth Prizes—Granger Indicator Co.; International Supply Co.; Chicago Pneumatic Tool Co.

Fifth Prizes—Brust Tool Mfg. Co.; Smallamatic Co.; Baldwin Tool Works; Robinson Supply Co.; Happy Belting Co.; Norris Bros., Inc.; Safety Division, Mid-Continent Oil & Gas Association; Worthington Machinery Corp.; Baird Tool Co.; Safety Pulling Machine Co.; R. E. Worthington Co.

new to this year's Exposition, the device has been field tested on many wells, and has proved its worth. Mr. Haper's suggestion was:

Second Prize Winner

"In my opinion the most notable improvement in equipment pertaining to my part of the industry is the chambered control head, which can be used to lubricate a high pressure well, or in putting a string of cable drilling tools into a gas or oil well of such pressure and volume that this operation would be impossible without this device.

"The top of the control head is threaded above the oil saver seat to receive a pressure chamber made up of casing long enough to receive the full string of cable tools. On all sizes up to 8-inch tools 10-inch casing is used. The head is made in sizes ranging from 4-inch to 10-inch. The top of the chamber is closed on the drilling line by a special stuffing box.

"A by-pass opening valve is connected to a similar opening above the oil saver seat. The chamber is made of three full joints of casing, and is handled on the calf wheels.

"The tools are run in the rat hole, the rope socket unscrewed through the chamber, and then made up again on the tools. A special oil saver is put on the line above the tools and a stuffing box is bolted on the line and made up on top of the chamber. The string of tools is pulled up into the chamber, which is then made up on top of the control head and the by-pass opened to equalize the pressure in the well and in the chamber.

"The control head is then opened and the tools lowered into the hole. As the oil saver seats the set screws which project below the pressure chamber are made up.

"When the tools are on bottom the by-pass is closed and the pressure chamber disconnected. It is raised enough to permit the wire line clamp to be put in place. Drilling is then carried on in the regular manner.

"The use of the pressure chamber in 'lubricating' the tools into and out of the hole avoids the spraying of oil or the waste of gas, and affords a protection to the important gas pressure in the pay, to the life and safety of the crew, and to the surrounding farm land or crops."

In awarding third prize, for the use of the improved "crummy," or tubing tong the judges felt that they were rewarding a suggestion for an improved article used the oil fields over. It was felt that this tong was a great improvement over those hitherto used, and that Mr. Cox, who suggested the new tong, had brought to general attention a greatly improved product.

"An improved 'crummy' or tubing tong which I saw at the Exposition," said Mr. Cox, "appealed to me as a real money saver for the company. It also provides a high safety factor. It is provided with three slips which engage the pipe by means of an alligator type jaw. It has a safety device which prevents the tong from slipping back while reversing the tongs to buck tubing. When the tubing is free the safety latch is easily thrown open to remove the tong."

The original list of prizes offered by NATIONAL PETROLEUM NEWS provided two equal fourth prizes of $25 each. Three ideas were entered which the judges felt should be given equal consideration and reward.

> Ideas concerning equipment for drilling and producing exhibited at the Oil Exposition at Tulsa which won $10 prizes, and other suggestions which were considered as good but were not prize winners, will be published in the next issue of NATIONAL PETROLEUM NEWS.

One of the three was the idea of the tubing leak finder turned in by Luke B. Dodds, lease foreman for the Mid-Continent Petroleum Corp. at Sasakwa. The tubing leak finder, in the opinion of the judges, is a much needed tool in all oil fields. It is a new idea, and fits an exact need which until the present has been filled by home made methods none of which could be considered entirely sure or satisfactory, and all of which were time destroyers.

"THE device consists of a metal barrel provided with four cups, two of which face downward and two of which are upright," said Mr. Dodds. "The device is put down a string of tubing which has been leaking, and fluid is put down the tubing on top of the tools. Pressure of the column of fluid on top of the leak finder, which is sealed against the side of the tubing by the top, or upright pair of cups, drives the leak finder down the hole. What fluid may be in the tubing below the leak finder is forced out through the leak as the tool is forced downward. When the bottom cups on the leak finder reach the leak they are stopped by the column of fluid standing in the hole below the leak. This fluid is non-compressible, and having no outlet, stops the leak finder at the leak.

"The device will prove an economy in the field in the time saved in hunting for leaks in the tubing. This will make it possible to get the well back on production in the shortest possible time.

"There are but 11 parts, all of them being corrosion resisting. The only parts that can wear out are the cups, which can be easily and cheaply replaced."

In giving another fourth prize to Hurley Smith, of the Sinclair Oil & Gas Co. at Shamrock, Okla. for his suggestion of the use of the safety spider, it was felt by the judges that this type of spider provided a safety factor on human life and on equipment which could not be overlooked. The speed and simplicity of operation of the spider was another point in its favor.

Said Mr. Smith, "I suggest, as a safety measure and as a means of increasing the speed of operation, the use of the spider using lever set slips.

"The spider consists of four slips operated by means of a four-foot handle, the latter so placed that, as it is pushed down, the slips are raised releasing the pipe. As the lever is raised the slips automatically fall into place around the pipe.

"This piece of equipment, which may be easily removed when not in use, is an improvement from the practice of using hand set slips. The old types of spiders were extremely heavy, and used slips which were put into place by four men who always ran the danger of losing a finger, or a hand, as they endeavored to adjust the cumbersome slips with the wire handles which were provided. One man may now easily raise or lower the slips without the loss of time or without danger to his or his co-workers' lives."

The third suggestion to tie for fourth place was made by J. W. Stricklin, driller for the Carter Oil Co. who suggested the use of the rotary bit which jets the slush directly on the bottom of the hole. In making his suggestion Mr. Stricklin said, "I believe that, from the basic principles of design, this bit will make hole cheaper, easier and straighter than other bits for the following reasons:

"First, the circulation is such that it jets directly on the bottom of the hole, no side wall hydraulicing, thus resulting in a straighter hole.

"Second, the bits are safer to use as there is less fear of fishing jobs. Extremely large bearing spindles are used. There are no cone bushings employed.

"Third, clearance in the hole is over 34 per cent of hole area, which reduces the chances of hanging up going in or coming out of the hole. Friction is reduced, and there is less chance of bits sticking in tight places.

"Fourth, one piece bodies eliminate the annoying and expensive bit head repairs which delay operations frequently.

"All these points are directed to cheaper operation for the drilling contractor. The direct impact of the slush on the bottom of the hole cannot be over emphasized, as it makes for straighter holes, and straight holes are the cheapest to drill and the cheapest to operate."

Oil Stocks in Wall Street Crash Fare Better Than Most

By Roger B. Stafford
N. P. N. STAFF WRITER

CLEVELAND, Oct. 26

OIL stocks were caught in the crash of speculative stocks Oct. 24 but as a whole the oil issues did not suffer such severe losses in market value as other industrial shares.

Holders disposed of oil shares more heavily than usual but the heaviest selling in the crash centered around Cities Service Co. which is both oil and public utilities. Sales of Cities Service exceeded 3,000,000 shares last week and the price broke from 68 to 45. There were heavy breaks in Indian Territory Illuminating Oil Co., Cities Service's phenomenal crude producing subsidiary in the Mid-Continent, and Arkansas Natural Gas Co., a Cities Service gas producing and distributing company, also in the southwest.

Natural gas stocks fell with other public utilities and heavy losses were recorded in the stocks of the Lone Star Gas Corp., Missouri-Kansas Pipe Line Co. and the National Fuel Gas Co.

All the trading in the foregoing was on the New York Curb market.

Reports of eight oil companies showing larger profits in the first nine months of 1929 than in the corresponding period of 1928, failed to stem the ebb tide of market values of the oil shares. These eight companies are the American Republics Corp., Atlantic Refining Co., Independent Oil & Gas Co., Phillips Petroleum Co., Pierce Petroleum Co., Transcontinental Oil Co., Union Oil Co. of California, and White Eagle Oil & Refining Co. Substantial gains were made by all of the companies and Transcontinental Oil Co. reported earnings which, before federal income taxes, were almost triple its earnings in the first nine months of 1928.

American Republics broke from a high of 34¼ to 20½ Oct. 24, Atlantic Refining from 56⅜ to 40, Independent from 30 to 25⅛, Phillips from 41 to 27⅝, Pierce from 3⅞ to 3½, Transcontinental from 12 to 6¼, Union from 51½ to 43⅝, and White Eagle from 34 to 29¾. When the panic had subsided, there were some notable rallies, prices in these eight stocks running as high Oct. 25 as: American Republics 26¼, Atlantic 49¾, Independent 27⅛, Phillips 38½, Pierce 3⅝, Transcontinental 9⅞, Union 48¾, and White Eagle 32.

Stocks Crash Again

CLEVELAND, Oct. 29.—The second great collapse of stock prices in Wall Street, Oct. 28, brought further declines to the oil group but the average decline of oil shares on the New York Stock Exchange was less than the average for industrial stocks.

The Associated Press average for 50 representative industrials fell approximately 25 points Oct. 28. The largest decline among the oil stocks on the main exchange was Houston Oil which was 16⅜ points off at the close. Indian was down 12, General Asphalt 10⅞, Atlantic Refining 9⅛, Standard of New Jersey 8, Royal Dutch 5¾, American Republics 5⅞, Pan American 5¾, Pan American B 6⅜, and Barnsdall 5½ but declines in other issues were less than 5 points.

On the Curb market, Cities Service was hammered down to 29 a decline of almost 40 points or approximately 60 per cent in a week.

These eight stocks are but samples of what most others did.

The heaviest selling among the oils on the New York Stock Exchange was of Standard Oil Co. of New Jersey. The New Jersey stock broke from 79½ Oct. 22 to 61⅝ Oct. 24 but Oct. 25 it was up again to 72½. The Texas Corp. was active through a smaller range, the top being 63 and the bottom 57¼ during the panic. It rallied to 60. Standard Oil Co. of California fell from a high of 72⅝ to 65 but rebounded to 69⅞, and Standard of New York went from 43 to 34⅝ and rose to 39⅞ Oct. 25.

Sinclair, another active issue, fell from 33¾ to 25, Oct. 23 but never sold below 26½ the day of the crash. Oct. 25 Sinclair rose to 31½. There were fluctuations of several points in Skelly Oil Co., Louisiana Oil Refining Corp., Mid-Continent Petroleum Corp., Pure Oil Co., Shell Union Oil Corp., Prairie Oil & Gas Co., and Wilcox Oil & Gas Co. but the higher prices of Oct. 25 were little below the prices of these stocks before the crash.

The relatively heaviest decline on the Curb market was the Indian Territory stock which fell from a high of 48 to 21. It closed Oct. 25 at 31½. Market value of this stock probably was influenced some by the partial shut-down agreement in the Oklahoma City pool. Gulf Oil Corp. declined from 186 to 158¾ and its last sale Oct. 25 was at 169⅝. Standard Oil of Indiana had a high of 56 for the week and a low of 52. Its closing price Oct. 25 was 56. The Standard of Ohio took one erratic dip from 95 to 75 and then rebounded to 100. It closed Oct. 25 at 98½.

Market prices of many of the oil companies were regarded as bargains during and even after the panic. This was because the oil stocks have not risen as rapidly as industrial and public utility stocks the last two or three years, although the leading oil companies are getting into position to reestablish their profit earning ability with the stabilization of crude oil production and better marketing practices under the code of ethics.

The crude oil price reduction in California affected the market stability of a few companies but the stocks of most of the companies that operate in California were able to withstand the shock of that radical cut fairly well. This was because the stock market evidently believed that the lower price of crude in California would aid the refining companies whose stocks make up most of the California representation in the New York stock market.

Oil Company Earnings

Condensed income reports of oil companies whose securities figured in the heavy selling on the stock exchanges Oct. 24. Prices for their securities did not suffer as much as those of other industrials.

Third Quarter	1929	1928
American Republics	$286,645	$167,735
Atlantic Refining	4,824,591	6,219,000
Independent Oil & Gas	1,463,007	2,445,854
Phillips Petroleum	†6,518,781	†5,846,156
Pierce Petroleum	394,457	424,225
Transcontinental Oil	‡1,804,271	‡825,066
White Eagle Oil	‡952,445	‡742,385
Nine Months	**1929**	**1928**
American Republics	$1,311,715	$903,851
Atlantic Refining	13,687,000	11,908,987
Independent Oil & Gas	5,097,503	2,138,973
Phillips Petroleum	†15,029,588	†12,366,133
Pierce Petroleum	979,718	791,683
Transcontinental Oil	‡3,520,093	‡1,348,032
Union Oil	12,000,000	8,550,000
White Eagle Oil	‡1,636,350	‡1,209,257
Six Months Ended June 30	**1929**	**1928**
Rio Grande Oil	$2,990,753	.....

†Before depreciation and depletion.
‡Before federal taxes.

Refined Markets Steady After Crude Cut

By J. P. Mosher, Jr.
Manager, Platt's Oilgram

CLEVELAND, Oct. 28

DEVELOPMENTS in refined oil markets throughout the country last week, following the drastic downward revision in California crude oil prices, were quite the contrary of what might have been expected.

Local refinery markets in California naturally were somewhat depressed by the lowering of raw material costs. In the Mid-Continent, however, there was the largest volume of export buying this district has experienced in a single week in many years.

Atlantic seaboard markets, probably the most sensitive of any outside market to a change in the California structural, showed no signs of wavering.

Western Pennsylvania markets, affected to a great extent by conditions on the east coast, were untouched and the middle western markets, centering around Chicago, assumed a bullish aspect following the heavy export buying in the Mid-Continent.

Market observers will look to the Atlantic seaboard for the first indications of any demoralizing effect the California crude reduction may have on light oil prices. A survey of the current situation there shows that stocks of California gasoline are in a very favorable position.

Due largely to the high levels at which tanker rates have been maintained for the past six or eight months, and partially to the relatively high prices California refiners have been asking for bulk shipments, eastern seaboard distributors have kept their purchases on the lowest possible working basis this fall. Unusually good fall consumption has depleted their stocks to the point where there has been considerable trading back and forth among the various distributors to fill the requirements of their contract customers.

Any further surplus of gasoline that may accumulate in California would doubtless be dumped on the east coast, but distributors there are in a good position to take on a large volume of stuff without its having any great demoralizing effect on their retail markets.

California bulk prices for gasoline dropped approximately 0.25 to 0.5 cent following the cut in crude. Against a minimum of 6.50 cents quoted for U. S. Motor for coastwise shipment a week ago, goods was freely available last week at 6 to 6.25 cents and experienced buyers believed that with firm offer they might even be able to shade the lower figure 0.125 cent.

Offsetting this, however, there was a further substantial increase in intercoastal rates for clean bottoms. A fixture made over next year was closed at $1.00 per barrel. This compares with a last paid price of $0.93 per barrel. Although this cannot be taken as the market, strictly speaking, for clean bottoms over next year it clearly indicates the trend of prices resulting from a relatively tight tanker market. And according to several students of this market, if a long time contract has been closed at this figure, there is every reason to believe that spot fixtures will be made at this and higher rates. Charterers already are asking $1.10 for single fixtures.

The relatively tight and advancing tanker market throughout 1928 has prevented California gasoline from displacing other goods as much as might have otherwise been expected. The current trend of tanker rates bids fair to prolong this condition on the Atlantic seaboard.

Fuel oil in California probably was the commodity hit the hardest by the drop in crude. Previous to the cut in prices, fuel oil had been selling at prices ranging from $0.50 to $0.60 per barrel. The slash in crude prices placed raw material costs considerably under this level, and as a result sellers were unable to get any more for their fuel oil than they were paying for their crude. Lack of actual spot business last week didn't even give them a chance to prove their ability to do this. A few local contracts were affected to the extent that buyers were getting their requirements at 10 to 15 cents per barrel.

Border Jobbers in Nebraska Lose On Gasoline Tax Refunds

CLEVELAND, Oct. 28

NEBRASKA jobbers are facing a disturbing gasoline tax loss on business done in adjoining states under a new ruling of State Accountant C. A. Sommers, according to a recent bulletin of the Nebraska Independent Oil Men's Association. Suits to collect back taxes on gasoline sold in adjoining states may be filed.

In Nebraska the state tax is 4 cents per gallon, while in Iowa and Kansas the tax is 3 cents. The state accountant has ruled that Nebraska jobbers can get refunds of only 3 cents per gallon on gasoline sold in the two neighboring states. In the past Nebraska jobbers have paid the tax on gasoline sold in adjoining states and obtained a refund of the total Nebraska state tax.

The Nebraska tax law reads: "The state treasurer shall have authority to authorize a refund of the amount of tax paid in states other than Nebraska, on sales of motor vehicle fuel therein, on which tax was paid in this state, said refund not to exceed per gallon the tax imposed by this state."

Since April 1, when the new law went into effect, Nebraska jobbers have exported 283,873 gallons into Kansas and Iowa and obtained 4 cent refunds. Sommers now advises the state treasurer to collect $2,838.73 or one cent per gallon from companies which have done the interstate business, or be personally responsible for that sum.

Under this ruling Nebraska border jobbers would have to build bulk stations to handle the business of customers in Kansas and Iowa or accept a 1 cent per gallon penalty on all gasoline sold. In other words Nebraska is seeking to tax gasoline sold in the two adjoining states because it is first imported into Nebraska.

No difficulty arises on business done in Colorado, South Dakota and Wyoming since these states each collect a 4 cent tax.

Dixie Considers Board To Supervise "Ads"

CLEVELAND, Oct. 28.—Dixie Distributors, Inc., is planning more uniform advertising for its products. At a meeting recently in Chicago plans were considered for appointing a board, consisting of one representative of each state, to supervise the organization's advertising activities.

Paul Kempf, of the Staebler Oil Co., Ann Arbor, Mich., is to be secretary of the board. Headquarters probably will be established in Ann Arbor. The board would meet every three months.

Eight states in the middle west are represented in the Dixie merchandising movement now—Michigan, Wisconsin, Illinois, Ohio, Kansas, Missouri, Nebraska, and Iowa.

Red Hat Roadside Sign Campaign Planned at I.O.M.A. Meet

CHICAGO, Oct. 24

INDEPENDENT Oil Men of America is going to renew its national advertising campaign of Red Hat products with highway signs. Announcement of the new campaign was made at the Marketing Congress of this association here Oct. 21, 22, and 23. Final details as to what cities will be used first will be decided by the board of trustees.

The signs will be metal cut-outs of the organization's hat emblem, four feet high. The hat will be in red, with the star studded band in blue. It is planned to erect signs on national highways near cities having jobber members.

A suggestion that Independent producers, refiners, and marketers merge their interests in one large organization was made by two speakers. C. S. Rosenthal, vice-president of the I. O. M. A., and president of the Apex Motor Fuel Co., Chicago, said so in an informal address. H. B. Fell, vice-president of the Independent Producers Association of America, in a formal address made a similar suggestion.

"The membership of the Independent Producers Association," said Mr. Fell, "is composed of Independent oil producers, Independent refiners, Independent supply companies, interstate pipeline companies, royalty owners, land owners, and permit holders, and I can see no reason why Independent marketers and distributors could not also be members.

Approximately 200 persons registered for the convention.

At the first meeting Monday afternoon Frank F. Harris, of the Chicago Association of Commerce, welcomed the convention. President E. H. Hilpp, in his opening address, spoke of competition between giants, Standard Oil and Shell, and suggested that possibly the government eventually would have to step in as a referee.

C. L. Maguire, Northland Oil Co., Chicago, said that he thought there would be more mergers in the coming year, but that mergers would be overdone. He said also that efforts to disorganize the jobber minority had solidified the organization.

C. Y. Hinchey, executive manager of the I. O. M. A., told the convention it was expedient for the moment to mark time in the organization but that it was more solidly composed than ever before. He outlined briefly the sign campaign.

Floyd A. Allen, a vice-president of General Motors Corp., spoke on "Trends and Policies in Modern Business" on Tuesday morning. Sturges Harmon, director of advertising, addressed the convention on "Membership Requirements."

That foreign oil holdings had been responsible for some of the larger oil companies declaring dividends and stock bonuses in recent years was set forth in an address by Mr. Fell, on "A Tariff on Crude" Tuesday afternoon. "It is evident that this branch of the industry (foreign oil holdings of large American companies) is making the profit, and the others are taking the loss, leaving the Independent group to suffer the loss," he said.

To show competition from foreign oil, Mr. Fell pointed out that the cost of oil from the well in Venezuela to Atlantic ports was about 75 cents a barrel, while it costs in excess to that amount to produce oil in the United States, let alone transport it.

"Imports have been a cause, and continually a constant source of distress to the domestic producer, and the present menace will be observed in the increasing amount of foreign oil being thrown upon the domestic market," he said.

Jay Trexler, director of the Red Hat department of I. O. M. A., said that the mental attitude of the Independent marketer determines his future. He said the individuality of the jobber is retained, and by using his personality he has an advantage over chain stores. Members were advised to sell from the customer's viewpoint.

L. S. Wescoat, a vice president of the Pure Oil Co., spoke on the code of ethics, Wednesday morning. Mr. Wescoat outlined the development of the code through the American Petroleum Institute to its adoption by many oil companies. The I. O. M. A. has not taken a stand on the code as an organization.

Wednesday afternoon H. B. Floyd, attorney for the I. O. M. A., detailed progress of Standard of Indiana's suit against the registration of the Red Hat trade mark. The Standard of Indiana was bringing suit to scare jobbers from joining the I. O. M. A., he said, as the question could be settled quickly as an equity suit in a U. S. District court.

Entertainment was a banquet and dance Tuesday evening and a luncheon Wednesday noon. About 25 equipment manufacturers had displays.

Alex G. Duncan
President of the new Icy-Flo Oil Co. of Youngstown, O.

Youngstown Men Buy Rights to Icy-Flo

CLEVELAND, Oct. 25.—Alex G. Duncan and his brothers of Youngstown, O., who sold their Duncan Oil Co. last summer to Cities Service Oil Co., have formed the Icy-Flo Oil Co. and bought the rights, patents and process of producing Icy-Flo motor oil from the Allegheny-Arrow Oil Co. of Canton, O.

Officers of the Icy-Flo Oil Co., which has headquarters in Youngstown are: Alex G. Duncan, president; Arch A. Duncan, vice-president; David J. Duncan, secretary and treasurer, and C. C. Lamb, sales manager.

All the Duncans were with the Duncan Oil Co. which had a chain of bulk and service stations in Youngstown and Akron. Mr. Lamb was formerly with the Arrow Oil Co. of Wooster, O., which developed the Icy-Flo oil more than a year ago and began national distribution of it about a year ago.

The Icy-Flo oil flows at 30 degrees below zero F. Its distribution is now said to extend to practically all parts of the United States.

The Arrow Oil Co. merged with the Allegheny Oil Co. of Canton, O., early in September and the consolidated organization is building a refinery at Canton to produce gasoline and fuel oil.

CLEVELAND—Original purchaser's invoices with payment acknowledged must be presented when making application for gasoline tax refunds in North Dakota according to State Auditor John Steen.

When a tax refund is to be sought the dealer must furnish the buyer with a ticket showing name and address of seller and buyer, number of gallons bought, price per gallon and amount of tax paid. Tickets must be plainly marked "Purchaser's invoice" and must be stamped paid. Refunds must be sought within nine months of date of purchase.

First of Chain of Hotels for Motor Travelers Opened by Pierce

By Roger B. Stafford
N. P. N. STAFF WRITER

ST. LOUIS, Oct. 29

THE first of five hotels the Pierce Petroleum Corp. is building to serve automobile travelers was opened Oct. 25 at Columbia, Mo.

A second hotel was to be opened at Rolla, Mo., Oct. 28, and contracts will be let for the erection of hotels at Tulsa, Oklahoma City, and Miami, Okla., as soon as Pierce officials ascertain whether they may desire to incorporate in the plans any changes suggested by a few weeks' operation of the Columbia and Rolla institutions.

The opening of the Columbia hotel was arranged for Friday the Twenty-fifth for two reasons, said E. D. Levy, president of Pierce Petroleum Corp. The first reason was the annual home-coming of the University of Missouri at Columbia with a football game Oct. 26, and the second that Mr. Levy believes that Friday is a lucky day for the Pierce company.

All the 40 rooms of the Columbia house had been reserved for the opening and up to Oct. 19, 97 applications for rooms had been turned down.

The Pierce or Pennant hotels, the latter being the copyrighted name tying with the company's brand name for gasoline and motor oils, are Y-shaped three and a half story Colonial style structures painted white with green trim about the windows.

The hotels are unique, there being no other places like them in the work, Mr. Levy said, and they represent mainly the ideas he has picked up or thought out in thousands of miles of traveling by automobile.

The prime object in building them is to provide a clean, quiet, and comfortable sleeping place for automobile travelers at a moderate price. They are not commercial hotels; they contain no office like a hotel, they have no lobbies, and no assembly or ball rooms. Each of the present two contains forty 12 by 16-foot sleeping rooms, each with bath and large closet. There are also on the fourth or attic floor, 10 sleeping rooms and four baths for chauffeurs and maids of patrons.

Quiet is assured because the hotels are built on 10-acre tracts three to eight miles from the centers of the cities near which they are situated and far enough from the highways so traffic will not keep the patrons awake like the noises of a city sometimes do.

E. D. Levy
President, Pierce Petroleum Corp.

Each room contains two full-sized beds, or sleeping accommodations for four persons. All bedrooms and bathrooms are outside rooms, each with windows so as to insure adequate ventilation. In addition there is a 12-inch oscillating fan in each bedroom and a 9-inch oscillating fan in each bathroom.

On the 10-acre tract but along the highway is one of the Pierce motor terminals which were described in NATIONAL PETROLEUM NEWS, issue of Aug. 1, 1928. The terminals contain restaurants where the hotel patrons may eat and also steam laundries which will be operated at night so that members of an automobile party that arrives as late as 9 o'clock at night, may have their soiled clothes washed and ironed by 4 the next morning if they wish to take the road that early.

The first floors of the hotels contain 40 parking spaces, room for one car for each room of the hotel. A party arriving does not drive up to the front door to be met by a footman, but through large doors into the first floor. There the car is met by a garage tender who makes a list of any services on the car that may be needed before the party leaves.

The attendant then acts as bell boy and carries luggage to the room which the manager—in the Pennant hotels, a woman bearing the title of hostess—assigns the patrons. The hostess goes to the room with the party and explains all the fixtures, the lighting switches, the shutters to the heating radiators which are set in recesses in the walls, the electric clothes drier, ironing board and iron concealed in a wall cabinet in the bathroom.

The hostess has a desk in a small first floor foyer. It is Mr. Levy's belief from his own experiences and from interviews with a great many automobile travelers that large lobby and office space is not necessary in hotels of the Pennant type because very few persons who travel by motor car wish to remain up late at night.

The hotels contain no elevators. An ice machine for generating chilled drinking water to each bathroom is the only piece of machinery in each hotel outside the electric fans, driers and suction cleaners.

During the night all glass of patrons' cars is washed, the tires checked, radiator filled, and upholstery and rugs aircleaned. There is no charge for this service and the garage parking space also is free. Room rents are $4 a day for one person, $6 for two, $7.50 for three, and $9 for four.

If the car is to be lubricated, the oil changed or the car washed, it is

driven to the terminals and the work is done during the night. When the patron calls for a boy to get the party's luggage from the room in the morning an attendant will start the engine so the car is warmed up by the time the party gets downstairs.

All rooms are alike and furnished alike. In the Columbia and Rolla hotels, the woodwork is jade green and the walls pea green. Furniture is all metal of Colonial design and finished in walnut. Carpets are also green.

There are prints depicting scenes from early American life on the walls instead of the usual French prints found in most hotels. Lamps are finished in antique copper and the parchment shades contain hand paintings of the progress of transportation from the ox cart to the automobile and airplane. Curtains are white.

Bathroom floors are of inlaid rubber and the walls of sheet rubber. Floors and walls are wax polished to simulate marble. The bathroom fans are set over the tubs so that they may serve as hair driers. There is a shower over each tub also. Bathroom fitments are plated with chromium.

Grip stands have been built into the closets, which are 5 by 6 feet.

Tickets for the hotels are sold by district offices of the Pierce company like Pullman tickets and reservations may be made just like Pullman reservations are made.

The hotel buildings have cost approximately $200,000 each, or about the same price as the terminals, so with the land there is an investment of approximately $500,000 in each of the Columbia and Rolla enterprises.

It is planned at present to make the three Oklahoma hotels a little larger than the two in Missouri. There will be the same number of rooms in each but each sleeping room will be 14 by 17 feet in the Oklahoma hotels instead of 12 by 16 feet.

The word *tourist* is not used by the Pierce company in any reference to the hotels. Mr. Levy said *tourist* brought up many unpleasant ideas about tourist camps, tourist lodges, "hot dog" stands and other encumbrances of the main highways. The Pierce company, he said, purposes to give the traveler by motor car a place to get a restful sleep in clean and comfortable surroundings.

There will be no radios in the hotels and no liquor parties will be permitted. No meals will be served in rooms but soft drinks may be ordered from the terminal restaurant and served in the rooms.

The Pierce project has attracted nationwide interest, Mr. Levy said, and the company has received requests from 44 chambers of commerce for the company to build like terminals and hotels near their respective cities.

While it is expected that a profit will be earned on the hotels and terminals, they have an advertising value which will please the company if they only carry themselves and earn a nominal return. Many unsolicited letters of commendation have come to the company from patrons of the terminals which have been in operation at some points more than a year.

The drawing power of the terminals has been demonstrated to the company's satisfaction by the Rolla terminals, comparative sales figures for which are now available. Sales of foodstuffs at the Rolla terminal last August were 62½ per cent larger than in August, 1928, when the terminal was new, and gasoline and oil sales have more than doubled.

The company estimates that 95 per cent of the business at the terminals is transient but that friends made there will buy Pennant products elsewhere in the middlewest and southwest, the company's marketing territory.

E. W. Field

President of the new Mid-Western Petroleum Corp. of Indianapolis. Mr. Field was assistant general sales manager of the Western Oil Refining Co. 10 years until Western was sold to Shell

Indianapolis Men Form New Jobbing Company

CLEVELAND, Oct. 25.—E. W. Field, formerly assistant general sales manager of the Western Oil Refining Co. of Indianapolis, and C. E. Foreman, who was auditor of the company, have organized the Mid-Western Petroleum Corp. to market two grades of gasoline, Pennsylvania and western motor oils, kerosene, greases and industrial lubricants. The company also expects to open a brokerage department to sell all petroleum products in tank car lots.

The company was formed shortly after the Western was bought by the Shell Petroleum Corp. two months ago and all its employes were formerly with the Western. It has a sales force of five men in Indianapolis and one outside that city in Indiana.

The company's headquarters are at 542 N. Meridian St., Indianapolis. It is building a bulk plant for its Indianapolis distribution and is negotiating to buy four plants outside that city.

"We think we have analyzed very carefully the possibilities of such an organization as ours, and frankly they look much better today than the day we opened our office," Mr. Field told NATIONAL PETROLEUM NEWS. "We have made a number of jobbing connections marketing under our trade names throughout the state."

The company calls its competitive grade of gasoline Nu-Gas and its anti-knock gasoline Hy-Red. He sells a Mid-Continent motor oil at 25 cents retail under the name Nu-Visco, and a 100 per cent Pennsylvania motor oil at 30 cents retail under the name Perfect Seal. Its greases are called Nu-Visco greases.

"It has been our thought to market only quality merchandise and to maintain an ethical marketing policy," Mr. Field said. "We are not price cutters."

CHICAGO, Oct. 26.—George B. Williams, sales manager of the Johnson Oil Refining Co., Chicago has presented his resignation effective Nov. 1. Mr. Williams has been with the Johnson Co. since June 1, 1918. His future connection has not been announced.

C. E. Foreman

Secretary-treasurer of Mid-Western Petroleum Corp., Indianapolis, who was auditor of the Western Oil Refining Co. 15 years until Shell bought it two months ago

Voluntary Curtailment Undertaken Again in California

By Jack N. Westsmith
N. P. N. STAFF WRITER

LOS ANGELES, Oct. 26

PLANS to reduce oil production in California 200,000 barrels daily average are being made as a result of the drastic reduction in crude prices announced Oct. 21 by the Standard Oil Co. of California.

The new plan is one of voluntary cooperative curtailment involving the appointment of an umpire to accomplish what has not been achieved under the gas conservation law. Efforts at voluntary curtailment were tried about a year ago but were not successful.

Court delays still hold up the gas law. Hearing in the Superior Court of Los Angeles County of the Santa Fe Springs case will not be resumed until Oct. 31, pending decision on an appeal taken from the ruling of that court to the appelate court.

An agreement was reached by a group of the larger Independent operators in the Santa Fe Springs field on Oct. 25, under the terms of which production from that field would be limited to 150,000 barrels for a 90 day period beginning Nov. 1. To bring production down to this figure the operators agreed to prorate their leases on the basis of potential tests.

Appointment of an umpire was to be made at a meeting on Oct. 28. The umpire is to check the gauges of all wells as he may see fit, inspect production records, fix potentials and announce the amount of production allowable from each lease. He is to advise pipe line companies of the allowable production from each lease and limit deliveries to that amount.

Following are the important features of the agreement dealing with potentials and enforcement of the proration:

"The potentials for the starting basis shall be established by a 24 hour gauge of the production from each lease in the field, to be taken under the supervision of the umpire. Such gauges to be completed prior to Nov. 1, 1929, or as soon thereafter as practicable.

"The potential of each lease and of the field shall be re-established semi-monthly following the effective date hereof on the basis of decline curves for each well in condition to produce, whether or not on production, provided, however, that in determining the potential production of a lease the potential production of a new well brought in on such lease subsequent to the beginning of the semi-monthly period shall be the daily average oil production of such well for the last four days of the first five days of its initial production. The production of any well brought in during a semi-monthly period between adjustment dates shall not affect the allowable production of the operator of such well prior to the next adjustment date.

"Each subscriber agrees that in the event the basic potentials have not been established upon which his allowable production is to be based, on or before 12 o'clock noon, Nov. 1, 1929, he will curtail production to 50 per cent of his lease production on that date, with the understanding that adjustments of his lease production will be made for and during the first semi-monthly period, to allow for the difference between the allowable production as established by the umpire and the amount of oil actually produced and delivered.

"Thereafter the allowable lease production of each subscriber shall be determined for the periods commencing on the 15th and 1st of each month and necessary adjustments of production for and during each such period shall be made to conform thereto.

"The umpire shall, as near as practicable to the first of each semi-monthly period, furnish each subscriber with a schedule showing the potential and allowable field production by leases for the period, as determined by him.

"The umpire may be removed and his successor elected or a vacancy in the office filled by the vote of a majority of all the subscribers at a meeting called for that purpose by five or more subscribers and at least forty-eight (48) hours' written notice of such meeting given to each subscriber."

Just what may result from this collecting of the Independents into a solid unit is not fully apparent but it is thought that a permanent organization may be formed.

The gas law hearing before the Superior Court of Los Angeles County will not be resumed until Oct. 31 and perhaps not then if the hearing called for Oct. 28 in the Appelate court is decided in favor of the defendants.

The hearing before the Appelate court is to determine whether or not Judge Hazlett of the Superior court erred in not granting a motion to bring into court all parties considered necessary by the defendants.

It was expected that antagonism on the part of Independents toward the gas conservation law would diminish with the crude slash but several of these minor operators take the attitude that Standard's action is an attempt to force them to do something they do not want to, they say "it's the principle of the thing" that they object to.

Oil workers are feeling the effect of the crude cut as much as any one. As many as 1500 men will be laid off during the week if normal crude prices are not restored.

Telegraph Bulletin

LOS ANGELES, Oct. 28.—Paul Grimm was elected umpire to have charge of voluntary proration in the Santa Fe Springs field at a meeting of operators here today. Mr. Grimm has had experience in the work he is to undertake through his chairmanship of the gas conservation committee in Santa Fe Springs prior to the time when F. C. Van Deinse was umpire.

Except for the Wilshire Oil Co., Independents in the field have agreed to the plan of cutting back production to 150,000 barrels per day, a reduction of about 115,000 barrels. Independents in other fields are organizing for voluntary proration.

HOUSTON, Oct. 24.—President Emilio Portes Gil of the Republic of Mexico has decreed the right-of-way and annexes of the National Railways to be a part of the federal petroleum reserves, setting apart all lands previously acquired or which may be acquired within national territory. The decree was issued under Fraction One of Constitutional Article 89, in conformity with Article 16 of the petroleum law of Dec. 25, 1926.

The Gil decree supplements one issued by President Calles, June 25, 1928, placing undeveloped lands within the national petroleum reserves. Article 1 of that decree dealt with lands coming under the classification of "free," in accordance with Article 6, Fraction 3 of the regulations of the petroleum law.

Degasification, Fractionation and Storage Of Pressure Distillate

By G. A. Burrell* and R. P. Mase*

(Presented before Western Petroleum Refiners Association, Tulsa, Oct. 28-29)

PRESSURE distillate as it leaves the receiver of a cracking unit is more or less charged with gas, depending upon the nature and degree of cracking and the pressure and temperature under which the separation of gas from the pressure distillate takes place. Upon release of pressure, as the pressure distillate leaves the receiving tank of the cracking unit, and in subsequent storage, treating, rerunning, etc., the gas is released and escapes taking with it appreciable quantities of gasoline which are thus lost.

In some cracking systems pressure distillate is discharged from the rundown tanks to untreated storage and then pumped through a continuous treater or to a batch agitator and thence to treated storage. From the treated storage it is pumped to a rerun still, then from the rundown tanks of same to the sweetening unit and from there to finished storage. This is done directly in the case of a continuous treater, but if a batch agitator is used for sweetening the process is lengthened and more handling is required. Finally the finished gasoline is pumped to the loading rack and tank cars.

All the while losses of gasoline are occurring, depending upon the amount of handling, the atmospheric temperature, and the extent to which expedients are employed to minimize losses, such as type of tankage employed, use of a vapor recovery plant, and degree to which various units in the refinery are hooked up to the gasoline recovery plant. These losses may range up to 4 per cent of the pressure distillate handled.

A further disadvantage of handling pressure distillate charged with gas lies in the difficulty of pumping it in hot weather.

Briefly it can be stated that degasification, fractionation and pressure storage of light fractions will perform a triple function, as follows:

(a) Degasify the pressure distillate (including propane removal).

(b) Fractionate a light overhead cut from the pressure distillate that does not need acid treatment. This fractionation raises the boiling point of heavy cut so evaporation losses are greatly reduced.

(c) Hold the light cut under pressure storage so that light gasoline fractions will not be lost during this storage.

Enlarging a bit on the first of the foregoing functions the benefit of fixed gas removal is quite evident in its broad aspects. The benefit from complete removal of all propane, the heaviest of the true fixed gases, is now fully realized since for each per cent of propane excluded from finished gasoline, three and a half per cent of butane may be added, at the same time retaining the same vapor pressure of finished product. This follows from a consideration of the relative vapor pressures of these two hydrocarbons.

For those refineries that do not have vapor recovery plants, but want only pressure distillate degasification and fractionation, a different procedure is adopted than where a vapor recovery plant will treat vapors from these units.

THERE will be first discussed a degasification and fractionation unit in combination with a vapor recovery plant. In degasifying pressure distillate, gas is taken off the receiver, say at 150 pounds and sent to a vapor recovery plant. This gas will contain up to 1.0 gallon of gasoline per 1000 cubic feet of gas. The pressure distillate is put into a degasifying column.

A PAPER by C. R. Wagner of the Pure Oil Co. on the production of a highly anti-knock motor fuel from the fixed gas output of Gyro process plants, which was read at the meeting of western refiners will be found on Page 173 of this issue.

This column operates at about 30 pounds, the pressure distillate being put into the column over the top plate. A mist extracting plate or unit should be provided above the top contact plate. With some pressure stills expanding the distillate from high pressure to a lower one (150 pounds down to 30 pounds) in the column, cools it and furnishes lowered temperature for the top of the column. Heat must be furnished for the base of the column, and this is provided by a closed steam bundle, preferably using exhaust steam from the hot oil pumps. The gas passing overhead is brought to vapor pressure—partial pressure equilibrium with cool pressure distillate at 30 pounds pressure. The gasoline content of this gas is, therefore, comparable to that of the gas ordinarily leaving a 30-pound separator.

This gas flows through the vapor recovery plant without being compressed.

Bottoms from the column (degasified pressure distillate) may be cooled and sent to storage. The hot bottoms, however, are preferably flashed into a second column at low pressure so as to take overhead a fraction of same (5 to 30 per cent) that does not need acid treating. Color, gum and odorous compounds more or less concentrate themselves in the heavy fractions of a distillate so that frequently a cut can be made and only the heavy portion of the distillate be acid treated.

By operating this second column at low pressure, part of the sensible heat of the liquid leaving the reboiler of the first column is used to evaporate the light cut. Additional heat (closed steam) may be needed for the base of this second column if a considerable fraction of the pressure distillate is sent overhead. A condenser of ample surface is provided for condensing the overhead cut of the second column. Part of the condensate thus formed is returned to the top plate as reflux, while the main stream is pumped to pressure storage. On its way it should be sweetened in a small continuous treater.

Preferably the light cut should be reunited with the heavy cut just prior to shipment. The blending can be done in the same manner as is ordinarily done when gasoline is blended with absorption gasoline.

The heavy cut from base of second column is cooled and sent to a run

*Burrell-Mase Engineering Co., Pittsburgh, Penna.

tank and is handled thereafter just as pressure distillate is now handled.

A diagram for a low pressure stabilizing-fractionating unit is shown at figure 1.

Since the function and operation of the unit is largely one of two stage fractionation, i.e., of stripping gas from a liquid in the first column and of removing light pressure distillate from the heavy pressure distillate in the second one, ordinary principles of rectification have to be followed. Enough heat must be put into the base of the column to drive overhead the light fraction.

The column must be of sufficient diameter to provide the necessary capacity and there must be enough plates for separation of the fractions. The necessary amount of reflux must be furnished the column, temperatures must be maintained as uniformly as possible; flow into the column must be constant, and velocities must not be too high. These are requirements of all columns, no matter what substance is being rectified.

Moderate heating is required for the base of the degasifying column (the 30-pound one). The temperature must be such as to drive out the gas at the operating pressure. The temperature ordinarily need not be higher than 180 F. for degasification at 30 pounds. Pressure distillate enters the column at about 60 F. Hence the temperature must be raised 180—60= 120 F. If one assumes 1000 barrels of pressure distillate per day this is the equivalent to 11,000 pounds per hour. Hence there is needed 11,000 $\times.50\times120=660{,}000$ b.t.u. per hour for heating above.

In addition, we must evaporate approximately 10 per cent of the liquid in order to drive out the gas. $.10\times 11{,}000\times125=137{,}500$ b.t.u. per hour for this purpose or a total of substantially 800,000 b.t.u. per hour. To this we must add about 10 per cent for heat loss, giving a total of nearly 900,000 b.t.u. per hour. If low pressure steam is utilized for heating this is equivalent to 27 boiler horsepower.

Most hot oil high pressure pumps used with cracking plants are direct steam driven and often this steam is wasted. As it leaves the pumps it contains 95 per cent of the heat of the steam. The steam required for the hot oil pumps of some cracking units is approximately 125 pounds per barrel of pressure distillate. From this it becomes apparent that for each 1000 barrels of pressure distillate per day produced there will be available on the order of 150 boiler horsepower of low pressure steam, while only 27 is needed for the pressure distillate reboiler.

The temperature at the top of the column due to the expansion of the pressure distillate into it will be of the order of 60 F. The gasoline escaping overhead with the gas is only that necessary to saturate the gas in contact with the pressure distillate at the temperature and pressure (30 pounds and 60 F.) of the latter. This will be of the order of 1½ to 2½ gallons per 1000 cubic feet and goes to the gasoline recovery plant to be recovered.

The stabilized pressure distillate now enters the second or fractionating column at a temperature a little less than 180 F. Enough heat has to be put into it to fractionate overhead up to say 30 per cent of the pressure distillate. If only a few per cent of the pressure distillate is taken overhead, the sensible heat already in the pressure distillate (180 F.) will be enough to drive overhead the desired fractions.

From some very sour pressure distillates it is possible that no tops can be taken off for the whole pressure distillate may need acid treatment. It is a fact, however, that the gum, color and odor forming constituents, concentrate themselves in the heavier fractions, so much so that a top cut can usually be removed that only needs a doctor wash. This can easily be determined in the laboratory.

If 30 per cent of the pressure distillate can be removed in the column, a considerable part of the pressure distillate must be driven from the base of the column. The top temperature can be controlled by thermostatically returning part of overhead condensate or by a partial condenser cooled by charging stock or water.

The foregoing arrangement of stabilizer and fractionating column, and accessories can be modified if desired, so as to utilize heat of the hot pressure distillate for column heating after the pressure distillate leaves the dephlegmator of the cracking unit, and before it is cooled. This waste heat can be utilized for bottom heat of the columns, instead of the waste heat from the exhaust steam of the hot oil pumps.

There remains to be considered a stabilizing — fractionating — pressure-storage unit for a refinery that does not have a vapor recovery unit, or may not care to install one. In this case, the stabilization must be conducted at as high a pressure, and low a temperature as possible, at the same time preferably contacting the overhead gas with heavy pressure distillate so that the gas leaving the unit will be stripped as cleanly as possible of gasoline. Under these conditions, one can resort to high pressure stabilization and absorption, as shown at figure 2.

Stabilization is conducted under the full pressure of the cracking unit, say 175 pounds. The first column becomes a fractionating and absorbing one, in that the partially condensed pressure distillate is put into the column at or near the bottom of same, while a heavy fraction of pressure distillate is taken out of the tower base, cooled,

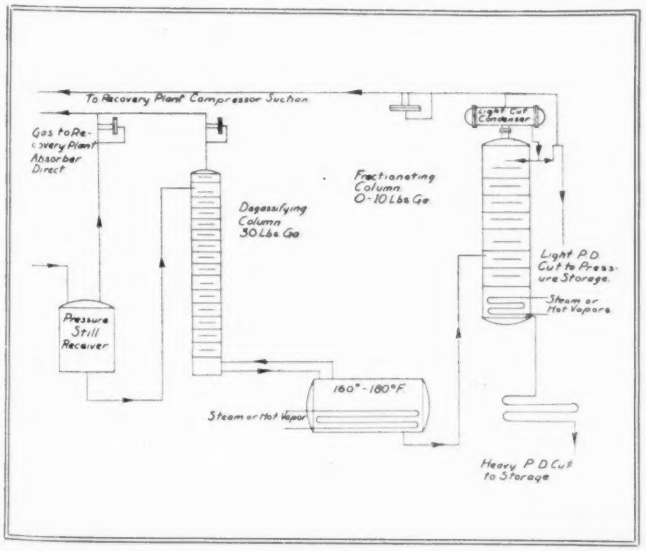

To Recovery Plant Compressor Suction
Gas to Recovery Plant Absorber Direct
Light Cut Condenser
Fractionating Column 0-10 Lbs. Ga.
Degassifying Column 30 Lbs. Ga.
Light P.D. Cut to Pressure Storage.
Steam or Hot Vapors
Pressure Still Receiver
160°-180°F
Steam or Hot Vapor
Heavy P.D. Cut to Storage

Fig. 1—Diagram of low pressure stabilizing-fractionating unit

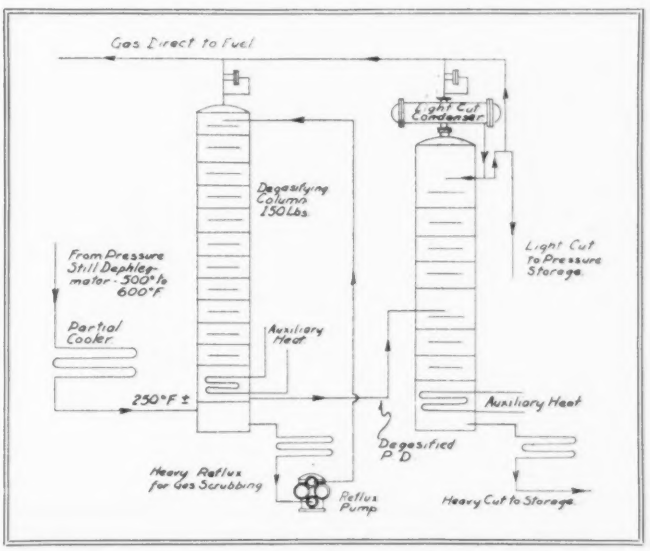


Fig. 2—Diagram of high pressure stabilizing unit

and recirculated to the top of the column, to act as a scrubbing agent, to rid the gas of virtually all the gasoline it carries, so that only dry gas leaves the top of the stabilizer, to be used as fuel.

The stabilized pressure distillate is then sent at lower pressure to a fractionating column, and a light overhead cut removed from it, which does not need acid treating, just as in the other arrangements already discussed.

Obviously, many minor variations may be introduced into the degasifying and fractionating equipment. Each refinery has its own particular problems and conditions which should be studied thoroughly before equipment is designed for that particular plant.

Wilde, Brian and Coleman[1] of the Humble Oil & Refining Co., decrease evaporation losses of pressure distillate by passing same from the cracking unit into a fractionating column at 120 pounds pressure, and an operating temperature of 375 F., at the bottom of the column, and 150 F. at the top. An amount of light gasoline plus gas equal to about 4 per cent of the pressure distillate, is taken overhead, the gasoline being stored at 100 pounds pressure.

Stabilized pressure distillate is removed from the bottom of the column. This method serves adequately for stabilizing the pressure distillate, but the light pressure distillate cut is charged with gas at 100 pounds and is exceedingly wild, so that such handling of it as is necessary entails loss. Further, expensive 100-pound tanks are needed. The present authors prefer to remove more of the gas from this light fraction.

Wilde, Brian and Coleman also stabilize crude oil charging stock before it enters the toppers or other crude stills. This is done by fractionating the crude oil in a tower, under pressure of 50 pounds, with a bottom temperature of 280 F., and a top temperature of 172 F. In some cases a light cut amounting to 4 per cent of the charging stock is removed overhead and stored under a pressure of 28 pounds until it is mixed with other gasoline and shipped. Gas is vented from the accumulator tank of the fractionating unit to a vapor recovery plant.

At one refinery in the Mid-Continent field degasification (stabilization) of the pressure distillate or pressure storage of a portion of same is not attempted but a 30 per cent cut of the pressure distillate is removed and not acid treated. This is done by means of a secondary tower attached to the cracking unit in that the pressure distillate is condensed as a whole in the receiver of the unit in the customary way, and then heat exchanged with hot pressure distillate from the dephlegmator of the cracking unit, and introduced into a column. A steam bundle in the base of the column furnishes the necessary heat, so that a top cut is driven overhead and condensed and not acid treated. Bottoms are thus stabilized and acid treated, but there is a heavy loss of the light cut.

At another refinery the pressure distillate is stabilized under a pressure of 300 pounds per square inch. This means that the pressure distillate must be pumped from the cracking system pressure of about 150-175 pounds, to the column pressure of 300 pounds. Overhead gas does not go to recovery plant but is used direct as fuel. The objection to this system is that in order to accomplish the desired separation it is not necessary to go to this high pressure with the resulting high pumping and heating cost.

[1]Oil and Gas Journal, Oct. 3, 1929, p. 222.

Standard Method of Taking Temperature Sought

(By Telegraph)

TULSA, Oct. 28.—Refinery technologists in attendance at the semi-annual meeting held under the auspices of the manufacturers committee of the Western Petroleum Refiners Association passed a resolution at the Monday morning session to have the president of the association appoint a committee to assist in obtaining and giving wide publicity to a standard method of taking temperatures in tank cars.

The resolution followed the reading of a paper by H. T. Bennett, chief chemist of the Mid-Continent Petroleum Corp. That committee would work with the American Society for Testing Materials and the American Petroleum Institute committees, and as soon as a practical method which could be made standard was devised the committee would do its share of the publicity work.

NATIONAL PETROLEUM NEWS, in two articles published in its Aug. 28th and Sept. 4th, 1929, issues, first called general attention of the industry to the great variety of methods used in taking the temperature of a tank car of gasoline, and the need for a standard method. Mr. Bennett's paper will be published in the next issue of NATIONAL PETROLEUM NEWS.

Approximately 75 technical men were present at the first session and heard the paper by Mr. Bennett on "Importance of Correct Temperatures in Tank Car Loading" as well as papers by Col. George A. Burrell, consulting engineer of Pittsburgh, on "Pressure Distillate Stabilization" and by Earl Petty, of the Smith Engineering Co., on "Vacuum Distillation."

Considerable discussion developed after the reading of each paper. No afternoon session was held, the members being taken on inspection trips through the Mid-Continent Petroleum Corp., the Producers and Refiners Corp., and The Texas Co., refineries in West Tulsa and Tuesday morning session was devoted to a description of the vapor phase cracking by C. R. Wagner, of the Pure Oil Co., and to refinery cost accounting as presented in a paper prepared by C. E. Votrain, of the Barnsdall Refineries, Inc. Mr. Votrain's paper was preceded by an introductory talk by F. E. Holsten of the Barnsdall Corp.

The final session was to be held Tuesday afternoon. F. M. Poole, of the Brown Instrument Co., Dr. W. J. Podbielniak and Peter Vilkas furnished the papers for discussion.

Changes in Editorial Staff of N. P. N.

CLEVELAND, Oct. 26.—Paul Truesdell, for 12 years a member of the editorial staff of NATIONAL PETROLEUM NEWS, has resigned that position as of Nov. 1 to associate himself with the Universal Oil Products Co. of Chicago, owners and licensors of the Dubbs cracking process.

Arch L. Foster, of the Bureau of Mines staff at Washington, will become a member of its editorial staff about Nov. 1. He will write news of particular interest to the refining branch of our industry.

Mr. Foster is a chemical engineer by training. Since his graduation from the University of Texas he has had practical refining and research experience in the industry in addition to the work he has done with the government bureau. Just recently he has supervised the filming of a new motion picture which shows how petroleum is refined.

Anglo-American Reported In S. O.-Vacuum Deal

NEW YORK, Oct. 25.—Inclusion of the Anglo-American Oil Co., Ltd., in the merger of the Standard Oil Co. of New York and Vacuum Oil Co. which is being worked out, is believed to be underway. The presence in New York of F. E. Powell, chairman of the board of the Anglo-American, is taken by the *New York Times* as proof that the English member of the Standard Oil group may become a party to the proposed consolidation.

Since the dissolution of the old Standard Oil Co. of New Jersey in 1911, the Anglo-American has been buying from American members of the group to supply its markets in the United Kingdom and Ireland.

Doherty Uses Double-Page Broadsides On Bar Association Meeting

CLEVELAND, Oct. 28

LAWYERS who attended the American Bar Association convention in Memphis, Oct. 21-25, were greeted the morning of the first day by the first of a series of five advertisements in the Memphis newspapers, each double-page, signed by Henry L. Doherty, head of extensive oil and public utility interests.

The space was purchased to set out the differences in opinion Mr. Doherty holds from many lawyers on the question of federal constitutional rights to regulate the production of oil.

The subject is a familiar one to the oil industry and, by this time, to the lawyers. Two years ago Mr. Doherty pursued a similar course when the bar association met in Buffalo. On that occasion James A. Veasey, general counsel for the Carter Oil Co., Tulsa, presented a study he had made of the constitutional powers of the federal government with respect to regulation of production.

Mr. Doherty started the Memphis series with the assertion that he had no desire to intrude on the proceedings of the convention, "but merely to contribute information that may be of value to those who might become committed to an erroneous opinion because the true facts were not known to them."

It is evident that Mr. Doherty anticipated action by the bar association on the report of the committee of nine of the mineral law section, of which Chester I. Long, of Kansas, is chairman. Although the report was discussed in the mineral law section, it was not acted upon.

The committee itself requested that, owing to voluntary efforts to stabilize the industry and, also, pending decision in the California gas law case, no formal action be taken. The mineral section resolved to defer such action until the next annual meeting of the section and the association.

There has been a gradual narrowing of the gap between the ideas of Mr. Doherty and those of some others in the industry. Some years ago he proposed compulsory unit development of oil and gas fields. He argued then that the federal government should control and cited theories under which it might act. He then had little support within the oil industry.

Unit Development Accepted

Unit development discussion went on until the industry is now largely favorable to cooperative exploratory and production work, but probably a majority of the operators hold the idea that, given sufficient time and experience, unit operation will be standard practice in the industry without calling in governmental supervision.

The report of the mineral law section's committee of nine proposed an element of compulsion. It contends that it is a state matter, however, and in the report it included a suggested state law. Under this operators in each pool would formulate their plan for cooperative development and the dissenting minority, if such existed, would, by law, be compelled to join in the plan of the majority.

Mr. Doherty and this committee, therefore, are together on the proposition that unit development will have to be brought about by law. Mr. Doherty, however, still contends that it is a federal matter.

After his rather mild beginning in his first advertisement, Mr. Doherty, who wrote the series on shipboard en route to France, became caustic. He said:

Chides Lawyers for Delay

"After six years of agitation by an army of lawyers, they don't know what the law will permit but can only tell us what the law won't permit. If there is any way to make lawyers cease exerting their efforts for delay, I do not know what it is, except to make them realize that they cannot stop you by methods most people employ to lessen the annoyance caused by an inquisitive child. . . . The lawyers at the beginning of this controversy, tossed off opinion after opinion and expected me to believe what they said, and they would have been afraid to have made the same statements to their own 10-year old grandchild.

"The story of oil reform will be one of delay and defeat if delay can accomplish defeat," was a bold face heading. Mr. Doherty then devoted a few paragraphs to the oil men.

"The oil barons who have, or think they have, a selfish interest in maintaining the vandalistic methods that now prevail in the oil production business and which are forced upon us by laws made by the courts and the states and which were born of ignorance and are vicious in effect, have managed for years to defeat any plan of reform," he said.

"For their principal line of defense and counter offense they depend upon their lawyers, and to argue with an instructed agent is about as productive of results as to hold a debate with a phonograph record. . . . They (the lawyers) not only express opinions which are in violent conflict with established facts, but they attempt to assert opinions and make others believe that they are supported by not only the mineral law section of the American Bar Association but by the entire membership of the American Bar Association as well."

Doherty Plans Public Campaign

Mr. Doherty went on in the same vein in the rest of his first article. He held out a warning that he intends to make a public campaign on this question of federal jurisdiction. He said: "If the oil lawyers and their supporters continue to insist that they are really right, then it is only fair to give all other lawyers the right to disclaim any right on the part of the lawyers who represent the oil industry and those lawyers specially retained to sustain the position of the Oil Barons in this controversy, the right to speak for them or for the American Bar Association, or any section or division thereof."

He charged, in several paragraphs, that the lawyers have thrown the whole matter of federal powers into a state of confusion and that the "ordinary citizen" so believes. Then he became specific as to what he considers the dangerous situation in the oil problem. He said:

"Oil is the most important munition of war.

"It is being wasted in a most shocking manner.

"What we waste today in oil may compel us to pay tomorrow for our folly of today in a ruthless sacrifice of the blood and treasure of the nation and in ghastly magnitude.

"The laws under which oil is produced necessitate a colossal waste.

"Our laws automatically bring about the depletion of our domestic reserves and automatically conduce to the conservation of oil in foreign countries.

"Our laws invite foreign companies to produce their oil here to supply their markets abroad and hold their ground reserves unimpaired in foreign countries."

Charges Hearing Was Denied

Mr. Doherty still longs for a chance to present his side of the

controversy "with some of my lawyer opponents who are the best informed and most intelligent and before some capable, intelligent and impartial tribunal. I nearly had an opportunity once for a public hearing before an intelligent tribunal, but I woke up to find that my bird had flown—the opportunity which I had prayed for had come and gone. A special hearing was staged by the Federal Oil Conservation Board on May 27, 1926, for the benefit of the special counsel for the American Petroleum Institute and I had been granted the right to be present and to reply to him. Immediately after he had read his brief, a short recess was declared and a few minutes later I was told by the chairman of the Federal Oil Conservation Board that the special counsel had insisted on being excused and had already left."

His reference was to the meeting at which Charles Evans Hughes, specially retained by the American Petroleum Institute, read his brief to the conservation board. Judge Hughes' opinion was that the federal government was without jurisdiction in regulating oil production on privately owned lands.

Mr. Doherty went on to say that he would like to have a public hearing, preferably in Washington. He would have the Federal Oil Conservation Board invited, the doors locked so that nobody could run away and the galleries not so well filled as to invite oratory. Said he:

"I would like to have a record taken down of the meeting and to have representatives present from the Army, the Navy, the United States Geological Survey, the Bureau of Mines and the Bureau of Standards, so the tribunal will not have to depend for facts relating to the science or engineering, or other non-legal and non-constitutional points, from my lawyer opponents or from me."

Offers Prizes to Charity

He then said that he was willing for the bar association to choose a committee of three or more to stage the debate and said he would particularly like to get Charles Evans Hughes, whom he did not refer to by name, into the arena with him.

Then he offered several prizes, $10,000 each and totalling $120,000, to be given to charity, if the committee he hoped the bar association would appoint were to find against him on the points he mentioned. Among these were the matter of deciding in favor of Charles Evans Hughes, of holding that the address of Mr. Veasey, at Buffalo, presented a correct statement of fact, aside from legal and constitutional matters, another award if the committee decided that Mr. Veasey was right on the law and if the committee decided that the now almost forgotten Committee of Eleven report to the American Petroleum Institute told the truth and bore evidence of a desire to comply with the conservation board's request for accurate information.

"Perhaps someone might think my offer over-fair and will want to make it more sporty or lucrative and will have sufficient faith in themselves or the Oil Barons may have sufficient faith in their attorneys to match what I have put up or raise my ante. I have not yet gone my limit and am a reasonable man and am open to other propositions.

"These Oil Barons are 'sporty people.' One of them is reported to have served notice on a competitor that, if competition was not keen enough as it was, he would agree to go to Atlantic City and match him in a contest of throwing $20 gold pieces off the end of the longest pier and see who would last the longest."

The Second Advertisement

His second installment was chiefly devoted to inveighing against the lawyers. He charged that they have dominated government throughout and that they have muddled things until no "ordinary citizen" and no lawyer, even, knows what the law is.

"The law profession is becoming most efficient as a means of blocking progress in other fields of human effort," he said. "After several decades of service in which I have led a strenuous and busy life, I have repeatedly been delayed and obstructed by having the law used as a mere pretense to obstruct or hold up the things I was trying to do in the interest of public service.

"If I have been impatient at times with the law or lawyers, I can plead some excuse, for in this last controversy, while I have not been afflicted with as many boils as Job and cannot claim his patience, nevertheless, I had my share of boils and for many months my adversaries and my lawyer opponents were able to romp over me and muss up all my plans while I suffered from the tortures of both neuritis and a general case of arthritis. I had to listen to enough bad legal opinions in this one controversy alone to have made a well man sick."

Mr. Doherty proposed in his newspaper advertisements, a long list of questions, all bearing upon the powers of the federal government under the constitution. It is his contention that, on the general theory of providing for national defense, the federal government can lay hands upon the production of oil. He said that, if the bar association takes him up on his challenge and makes a decision that the federal government has no power in this matter, he will start a campaign immediately to amend the constitution.

The Third Advertisement

"Some facts regarding oil and gas laws," is the heading in the third installment. Mr. Doherty "briefs his brief," as he says, in the following words:

"I cannot write what a lawyer erroneously calls a brief on the Powers of the Federal Government to legislate to prevent the waste of oil and yet confine it to say 2000 words, because it is necessary to also state enough facts to show that oil and oil laws are different from everything else, but I can express some of my thoughts on this supject and the reasons for them.

"In other words, I can try to 'brief' my 'brief.'

"The waste of oil and gas can only be prevented by operating pools as 'units' or as districts working in harmony to make up a complete unit.

"In spite of the years of opposition, no reason, which has sufficient merit to make it worth serious consideration has been advanced against the operation of pools as 'units.'

"In fact, the violent and blind opposition to the 'unit operation' of pools by the men of the Oil Industry was later superseded by a recognition of the merits of the plan, but to save their faces, the oil men tried to adopt it under the disguised name of 'voluntary cooperation,' but still continued to aggressively oppose the idea of compulsory operation of pools as units.

"Legislation Requiring Joint Operation of Property Not New and the Courts Have Given Emphatic Endorsement of It

"Voluntary cooperation has since been attempted and is now in operation and in several pools and for many months, and is securing in various degrees a wider and wider application, but cooperation as a voluntary matter can never be a sufficient factor to protect many of our oil deposits from various degrees of vandalistic exploitation.

"Legislation which forces cooperation of property and its owners is not new and numerous examples of the right to so legislate can be found.

"The most direct and comparable example is the State legislation regarding irrigation of land and swamp drainage, but there are many other examples such as provisions for growing cranberries and oysters, and still other examples of joint development, control or operation of properties which at first glance are not so easily recognized.

"To an Ordinary Citizen, it seems as though these laws are based on a 'natural' law that one property owner should not be allowed to use his property so that it would injure the property of his neighbor, and also the 'natural' extension of this law that one property owner cannot refuse to cooperate and therefore, prevent all other property, of which his is a necessary part, to be so improved, used or exploited, so as to give to all of the property its most beneficial use and its greatest value to all of the property owners as a whole.

"The Courts have emphatically sustained such legislation.

"Every Other Civilized Government in the World Is Alive to the Great Importance of Oil While Our Government Has Been Indifferent to It and May Now Only Be 'Toying' With It

"The oil problem is considered by every other civilized nation in the world, except us, to be one of paramount importance.

"There are so many reasons why the Federal Government should assert its exclusive right to legislate as to how oil should be produced that it would be impossible here to enumerate them all, but some of the many important reasons can be cited.

"It might be well here to say that I do not assert that the Federal Government has any right to legislate in regard to the production of any other product but oil, and I seriously doubt whether it has any power except as to oil.

"No Right Believed to Exist and No Right Claimed That the Federal Government Can Legislate for Natural Resources Other Than Oil

"Unless there are some facts about other products not known to me, I am confident the Federal Government has no such power if the Constitution is strictly and properly interpreted.

"It has been frequently urged by others that if the Federal Government has the power to legislate regarding the production of oil, then it has the power to legislate regarding the production of all natural resources.

"I do not know whether the people who maintain this position lack the information regarding the differences regarding oil and other products or whether they simply lack the intellect whereby they can discriminate from the conditions which surround oil and other products, or whether they are shrewdly asserting this merely as another and further means to confuse the issue and defeat legislation by the Federal Government regarding oil.

"The Importance of Oil and the Effect of Our Present Laws

"Oil is our most important munition of war.

"We do not know how much is left.

"The only evidence that anybody has ever offered that we still have an abundance is the fact that a shortage has frequently been predicted but has never come true.

"All the evidence that can be produced and that is entitled to rank as true evidence would indicate that a shortage is imminent.

"No other product is subjected to laws which enforce waste.

"No other product is subjected to laws which enforce the exhaustion of our domestic supplies.

"No other product is subjected to legislation that automatically conduces to the conservation of foreign oil.

"No other product, so far as I know, can be increased by merely changing the laws under which we operate.

"While we can now definitely assert that we can produce more than double as much oil as we can under our present system, nevertheless, by adopting sane laws, we might be able to make our domestic oil enormously more proficient from a war standpoint.

"If we were operating under sane laws, we would not be compelled to exhaust every pool as quickly as it is found, nor to burn it as quickly as it is produced.

"In Event of War We Must Not Be Dependent on Foreign Oil Subjected to the Risk of Ocean Transportation But Must Have a Domestic Supply

"Even without further progress that what is now possible in aerial warfare, we would not be warranted in depending upon oil produced in foreign countries and subject to the risk of ocean transportation.

"No other product needed for war purposes, and which has to be used for war purposes, is required in such quantities but that it could be stored for use in times of peace for war periods or the cargoes would be required in such relatively small numbers as to make it possible to safely convoy these cargoes both by armed vessels and armed aircraft.

"By sane laws we would build up, if we still have the deposits to do so, vast reservoirs in all of the oil producing areas and would be able to supply our Navy and our Army needs, and especially for our manufacturers needing increased quantities of oil to produce other war munitions.

"If we were operating under sane laws, we would, if we still had sufficient undiscovered deposits, build up huge ground reserves of oil, which, if necessity demanded it, could be drawn upon practically overnight to supply the greatly increased needs for oil if war should come."

"If anybody," said Mr. Doherty, wants to comprehend the terrible consequences of our present oil laws, he need only picture in his own mind what would happen if we tried to apply these laws to other properties. For instance, say a man died leaving a beautiful home and he had eight heirs. Under the oil laws, the heirs would all rush for the house, grab whatever they could of the furnishings in the house, tear down the drapes on the windows, tear out the electric light fixtures and pull up the plumbing fixtures by the roots and then kill the family cow and everybody would see how much meat they could chop off from her carcass and carry home."

"State Laws Unconstitutional"

Mr. Doherty devoted part of his fourth advertisement to asserting that the "state laws regarding oil production are in conflict with the property guarantees in the federal constitution and should be declared unconstitutional." He said that many lawyers were confused as to his position, as they were unable to conceive of federal legislation that effects conservation and at the same time does not constitute a taking of property without due process of law.

His concluding advertisement discussed the interstate compact idea, sponsored by the present federal administration in a meeting last June at Colorado Springs. He asserted at the outset that this idea was hatched by the "oil lawyers." He said: "I do not know whether they were sincere in this or whether this was simply another method to fight off the 'bugaboo' of federal legislation." Later in discussing this subject he asserted that he understands that, since the Federal Oil Conservation Board has taken up the compact between states idea seriously, all of the oil lawyers are against it.

The series was ended in this language:

"In closing, I respectfully request the American Bar Association to either accept my suggestion for the creation of an impartial tribunal to hear and give the best decision that is possible on this important and troublesome subject or, without regard to me, then to take such other action as the association deems best to make the lawyers who speak, and attempt to speak for the entire law profession, to be definite, constructive and decisive rather than to create endless delay and confusion."

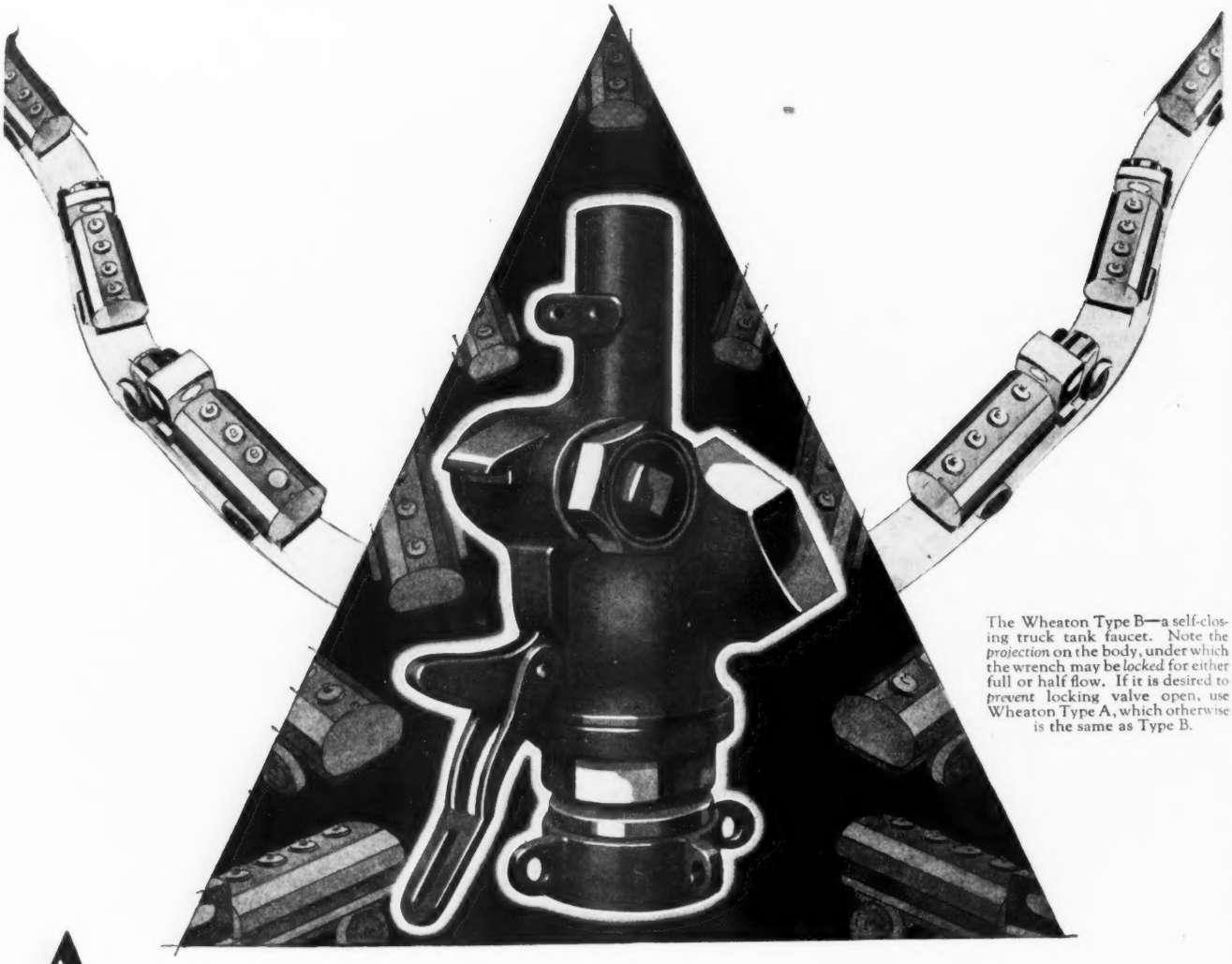
Scouts Association Makes Field Trip

SULPHUR, Okla., Oct. 26.—Seventy-five scouts, production superintendents and geologists were present on the first day of the field trip through the Arbuckle Mountain region of Oklahoma, sponsored by the Mid-Continent Scouts and Land Men's Association. The trip, a two-day affair, was started Oct. 25.

Led by Oscar Hatcher, geologist for the Gypsy Oil Co., William R. Gahring, of the Continental Oil Co. and Jack M. Copass, of the Amerada Petroleum Corp., study was made of the complete geologic section that outcrops near Turner Falls, Okla.

In the evening the party was entertained at dinner and smoker and talks were made on geology of the region visited. The second day's program included a trip led by Clifford Byron, Simms Oil Co., to the asphalt mine near Daugherty, Okla. and to resume the study of geologic features. A noon barbecue was also a feature of the day.

Most of the major companies in the Seminole district were represented and those attending express high satisfaction with the educational value of the trip.



The Wheaton Type B—a self-closing truck tank faucet. Note the *projection* on the body, under which the wrench may be *locked* for either full or half flow. If it is desired to *prevent* locking valve open, use Wheaton Type A, which otherwise is the same as Type B.

America's Greatest Oil Companies are RIGHT!

By their purchases during the last decade and a half, America's greatest oil companies have shown a distinct preference for Wheaton Truck Tank Faucets. In their *continued* selection of Wheaton—after so long an experience—they must be RIGHT! * * * One of the most popular Wheaton Faucets with many of these companies is the Type B, pictured above, made of special analysis bronze—tempered, toughened and tested, and perfectly fitted and finished. * * * Send for a sample of Type B today. Give it your own test. If you are not entirely satisfied, you may return it for credit or refund.

A. W. WHEATON BRASS WORKS
Newark, New Jersey

Empire Brass Mfg. Co., Ltd., London, Ontario, Canadian Manufacturers and Distributors

Wheaton

FAUCETS · VALVES · JOINTS · COUPLINGS · FILLERS · NOZZLES · FITTINGS

JOE CAMPBELL, who heads the Oklahoma State Federation of Labor, announces that a campaign will be started to organize oil field workers in this state. He intimates that a fairish amount of money will be spent in the undertaking.

Inquiry among employers reveals that nobody is much lathered up over the announcement. Various attempts have been made in the past to get oil field workers into the dues-paying class, but little have come of them. Oil companies do, as a matter of good business, the things that workers in other industries have contended for throughout the history of the labor movement.

Take any industry which employs men in outdoor work and no where else will you find the provision made for the health and comfort that is found in the average oil field company camp. Decent wages, sanitary living conditions, organized accident-prevention work, company-maintained schools—these make for satisfied workers.

Our guess is that Mr. Campbell will find the going rough.

* * *

Died: In Chatham, N. Y., Hugh King, pioneer oil producer and refiner. He was 78 years old. Mr. King came to America from Ireland in his youth, engaged early in the oil business. He was one of the founders of the Washington Oil Co., later sold to the Standard; was a founder and for many years a director of the old Pure Oil Co. and the United Pipe Line Co.

He started the Columbia Oil Co., which the Shell interests bought. He was an organizer of the Cortez Oil Co., of which a son, Hugh King, is president and another son, John B., is vice-president. They live in Tulsa. Deceased is survived by four sons and four daughters. Funeral services were held in New York City, where he had made his home for years.

* * *

One Raymond Crist, writing in a Cincinnati newspaper, has supplied our chamber of commerce and daily newspapers with text for discourse. He penned this literary nosegay: "Tulsa is a typical oil town after the boom. There are whole blocks of store and office space for rent. Scores of jobless ex-oilfield workers swarm the streets. There is a general dearth of business activity."

* * *

Ellick Botts, the popular ex-pumper of the Gray Horse district, says that after he has had a hard night the town looks that way to him, too.

* * *

Perpetuation of Species Note: A bus line owner in Muskogee gives a $50 bonus to each employe who reports the arrival of a baby.

* * *

W. M. Sturges has been made purchasing agent for the Anderson-Prichard Oil Corp., Oklahoma City. He formerly was research manager. H. G. Donnell, who has been purchasing agent, has been assigned to other duties in the company.

* * *

Frank Butram, Oklahoma City operator, appears to think highly of the territory north of Oklahoma City. He was awarded lease on the SW of 16-13-3W, a state school section, for $20,500 cash and $32,000 in oil, when, and if produced. Magnolia Petroleum Co. recently made location for a well in the vicinity.

* * *

Overheard in a hotel lobby: "Yes, that last gallon I got from him was pretty good. It aged six months while he was in jail. Now, if they will send him up for a year sometime, be sure to catch him as soon as he gets out."

* * *

Our old friend Holland S. Reavis, of New York, had a piece in the paper the other day saying that there is too much talk about overproduction of oil. He contended, in the New York Evening Post, that the industry "should look upon an abundant supply with thanks and gratification. In fact, this very abundance is a stabilizing factor—it means that the enormous investments in manufacturing and marketing equipment are safe for many years to come.

"The calamity howlers who shiver at the sight of a few millions of barrels of excess production should be made to sing, 'Praise God From Whom All Blessings Flow.' Certainly this abundance of oil is a blessing, although in disguise to many shallow thinkers in the industry. (I exclude from all consideration the companies which stored millions of barrels with speculative intent.)"

Certainly Mr. Reavis hits upon a tendency that is becoming increasingly apparent in the oil industry. That is the tendency to go ahead with the finding of oil, restricting its production to market requirements after it is found. The expediencies of today become the standard practices of tomorrow.

* * *

Died: In Rochester, Minn., Charles F. Shidell, Eldorado, Kans., oil producer. He was 55 years old. Mr. Shidell recently was active in the McPherson county, Kans., fields.

* * *

D. J. Moran, president of the Continental Oil Co., has been elected a director of the Exchange National Bank, Tulsa.

* * *

Oklahoma City councilmen let the bars down for some close well spacing when it annexed a district out in the direction of the oil field. It provided that not more than one well may be drilled per block.

* * *

A. G. Oliphant, oil operator, has been elected a member of the board of trustees of the University of Tulsa. He has in the past few years performed several notable services for the school, outstanding being the presentation of the Solon Shedd geological library of 6500 volumes.

* * *

Ten Years Ago

(From National Petroleum News, Oct. 29, 1919)

T. J. Gay, Little Rock, elected president of Independent Oil Men's Association.

Victor H. Smith organizes Orient Petroleum Co., to engage in marketing business in Fort Worth.

Prominent government technologist predicts that production of crude oil will reach maximum in two to five years and will thereafter steadily decline.

Sinclair Consolidated buys C. J. Wrightsman properties in Bull Bayou field, Louisiana, for reported $3,000,000.

W. H. Rowe, Shreveport, sells Rowe Oil Corp. properties in Homer field to Simms Petroleum Co. for $7,500,000.

H. F. Wilcox Oil & Gas Co. increases capital stock from two million to twenty million dollars.

American Industry *needs more* Natural Gas!

THE expansion of the natural gas industry is one of the outstanding developments of this century. Yet, from today's heights of achievement, the industry looks out upon ever widening fields of opportunity. Where fuel is cheap and abundant, old industries expand and new industries appear—and population follows industry.

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Workings of Proration the Principal News of the Mid-Continent

By Lawrence E. Smith
N. P. N. STAFF WRITER

TULSA, Oct. 26

THE Mid-Continent territory passed, during the week just ended, one of the dullest seven-day periods of recent years. Of course, there were the usual number of routine completions, all adding their bit toward making proration a necessity, but the trade has become so spoiled since the beginning of the Seminole era of petroleum that the week which sees no pool opened by a well of imposing caliber is a tame one, indeed.

One couldn't even discuss the effectiveness of the present proration to while away the time. Reports are heard that it is working out very well, that everybody is doing his full share toward making it a success. But the actual statistics are lacking and it will be several days before an accurate summary can be obtained.

The impression is gained that every operator is going along, cooperating 100 per cent in every way save one—that of supplying figures promptly. Most of the companies are performing all right in this respect, but there are enough who have not reported to the umpire for several days to make estimating a bit hazardous.

The best that could be arrived at Saturday was that production in Oklahoma averaged for the previous seven days 685,000 barrels. If that is true, a decrease of some 23,000 barrels is indicated.

Umpire Collins expects to have the complete figures on the standing of proration in the various pools before the month ends and each operator who is "over" his allowed amount will have time to correct. The only question is one of detail and not of willingness to cooperate.

The most important wildcat find of the week probably was the test of Slick, Pryor and Lockhart in McPherson county, Kans. It was referred to in these columns last week as having filled up 1500 feet with oil. It was drilled deeper and started flowing 20 barrels per hour. Its location is the NE NW NW of 34-20S-3W and it is a mile north of the Derby Oil Co.'s well which really opened the Voshell pool whose possibilities were indicated by a test put down months ago by Ted Washbaugh and others but which never was successfully completed.

Unlike the Derby well, which is now shut in under an operators' agreement, the Slick et al test is producing from the chat formation which is a persistent, and frequently annoying, horizon in this general area of Kansas. The Derby well is a Wilcox sand producer. The chat formation is the top of the Mississippian lime, is a "rotten," clayey and frequently cherty formation of inconsistent porosity and is frequently cavernous.

It always carries much water and is not regarded as being of economic importance except as an indication to the possibilities of the underlying Simpson and Wilcox. Occasionally a well "pays off" but the majority do not. The Slick et al well, therefore, is currently important as an indication that the Voshell pool's Wilcox extent may be sizable.

Oklahoma City's status remained unchanged during the week, with no completions not previously reported. The No. 2 A Bodine, SW NE SE of 24-11-3W, began showing water, although in small quantity. The field's production for the 24 hours ended Saturday morning was 69,310 barrels, distributed as follows:

Company	Well	Production	Remarks
Coline	1-Olds	4,511	
Cromwell-Franklin	1-Trosper	3,942	
Hall-Briscoe	1-Childs	7,411	
I.T.I.O.-Foster	1-B. Anderson	.....	shut in
I.T.I.O.-Foster	2-A. Bodine	1,722	showing water
I.T.I.O.-Foster	1-S. Bodine	1,953	3,190 water
I.T.I.O.-Foster	2-S. Bodine	108	drilling
I.T.I.O.-Foster	1-Button	4,191	
I.T.I.O.-Foster	2-Button	.....	shut in
I.T.I.O.-Foster	1-Fuzzell	14,591	
I.T.I.O.-Foster	1-Johnson	2,034	
I.T.I.O.-Foster	1-Henning	490	1,614 water
I.T.I.O.-Foster	1-Fee	1,673	4,258 water
I.T.I.O.-Foster	1-Trosper	1,215	710 water
I.T.I.O.-Foster	1-Watters	.....	shut in
Mid-Kansas	1-Fortson	2,226	
Mid-Kansas	2-Fortson	2,206	
Mid-Kansas	3-Fortson	.....	shut in
Prairie-Slick	1-Hiddleston	4,280	
Shell	1-Petty	8,504	
Sinclair	1-Stamper	2,960	
Sinclair	2-Stamper	.....	shut in
Sinclair	3-Stamper	.....	shut in
Slick	1-Glidden	.....	shut in
Slick	2-Glidden	.....	shut in
Franklin	2-Lowery	5,293	

The wells listed as shut in are in that status in compliance with the former proration order which shut in the field for 30 days, the same applying to drilling wells.

The position on structure of some of the wells now drilling along the east side of the field suggests that a limitation in that direction may soon be found.

South of the field the test of the Prairie Oil & Gas Co. and T. B. Slick, in the NE NE of 8-10-2W is drilling at 2345 feet, having topped the Viola five feet higher. A small show of oil was reported at 7325-30 feet. This one was long ago given up as a failure, but the owners are going to carry it to its logical conclusion.

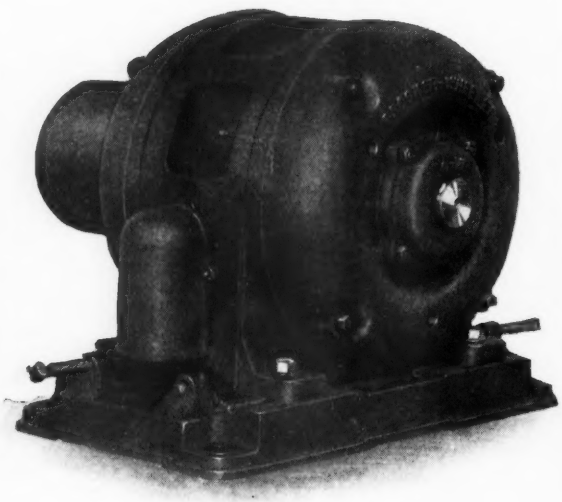
Getting back into the familiar territory radiating from the Seminole field, the wildcat test of the Amerada Petroleum Corp. and the Indian Territory Illuminating Oil Co., in the NW NE NE of 15-7-3E, Pearson area of Pottawatomie county, appears to be a failure in the Wilcox. Some weeks back it was highly touted because of production in the Hunton lime. It topped the Wilcox at 5040 feet, getting nothing but water.

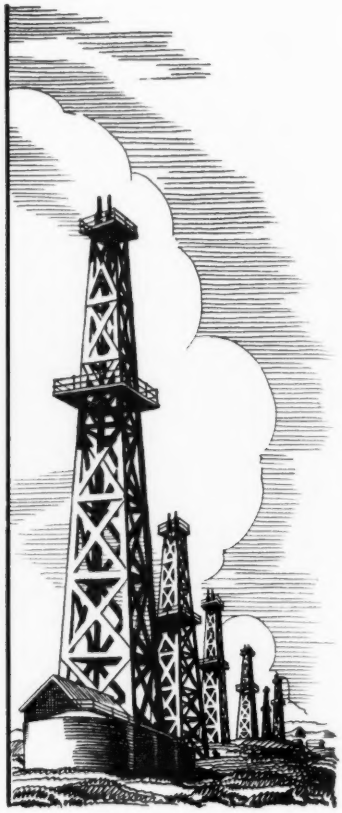
In the next township north another wildcat which had the folks stirred up for a time, causing them to buy royalties, is likewise a failure. It is Sunray Oil Corp. and Cal-Cul Oil Co.'s test in the NW NE NW of 9-8-3E. It had Simpson formation at 5310 feet; a show of oil at 5405-15 feet; green shale at 5415-25 feet and the Wilcox at 5485-90 feet.

* * *

Notes on the Week

In the Texas Panhandle a good well was completed in the area east of Lefors, Gray county, by the Panhandle Refining Co. It was No. 3





It's a Motor Trip... *all the way*

EVERY step of the way from the field to the consumer motors play an important part in the handling of oil. Many of these motors are operated under normal pumping and manufacturing conditions while others must meet conditions peculiar to producing, handling and refining of petroleum products.

Crocker-Wheeler Engineers have studied motor requirements for the entire industry. For every special motor application they have developed a specific motor. Speed and load conditions were considered. Flame and flash proof types have been designed to make it safe for motor operation around highly combustible materials. There is one common denominator however to all the motors . . . . .

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Saunders, Sec. 3, Block 1, A. C. H. & B. Survey. First oil was found at 2480 feet and the well has total depth of 2484 feet. Initial production, 1370 barrels of oil and 11 million feet of gas. Production is extended a half mile to the south in the area, which has been quite spotty in results.

* * *

Plains Petroleum Co., local operators, of Wichita, Kans., has put its discovery well west of Wichita on the pump. It was reported last week as opening a new pool. It topped the Simpson dolomite, from which wells in the Valley Center pool produce, at 3389 feet. On the pump it is making around 300 barrels daily, but is also making about 100 barrels of water with it.

* * *

Prairie Oil & Gas Co. and others test west of Sasawka pool, in the NW NW SW of 36-6-6 is a Wilcox failure, 4002-22 feet.

* * *

The new Texas-Empire Pipe Line, from the Mid-Continent to Chicago with a branch running to Stoy and Lawrenceville, Ill., is now shipping the following amounts of oil: For Tidal Oil Co., for delivery to Tidewater Pipe Line at Stoy, Ill., 8000 barrels daily; to Indian Refining Co., Lawrenceville, Ill., 5000 barrels; to The Texas Co. refinery at Lockport, Ill., 15,000 barrels. About Nov. 5 delivery will be started to the plant of the Empire Refineries, East Chicago. This plant will not be put into operation until after the first of the year but accumulation of crude oil in the large storage will be started.

* * *

Mid-Continent Petroleum Corp.'s wildcat west of Caldwell, southern Sumner county, Kans., is a failure in the Wilcox, 4853-70 feet. Its location is the SE corner of 31-34S-3W.

Salt Flat Recoveries 10,000 Bbls., Acre

HOUSTON, Oct. 25.—Average crude oil recovery from the Salt Flat field, second important development in the Luling fault zone region, had reached above the level of 10,000 barrels per acre late in October. The field was producing between 38,000 and 39,000 barrels daily from 1165 productive acres, or at the rate of nearly 1,250,000 barrels monthly.

Pipeline figures showed actual total recovery, Oct. 1, of 10,841,721 barrels, or more than 9300 barrels an acre averaged for the field.

Leaseholds on which production has been developed approximate a total of 2875 acres, on which the adjusted recovery amounts to an average of about 3770 barrels an acre.

Behavior of the Salt Flat field, northeast of the town of Luling, has indicated that ultimate yields will exceed final recoveries to come from the old Luling field, which lies *en echelon* about five and a half miles northwest.

Southwest of Luling, in the Caldwell-Guadalupe area, the new Darst Creek development, in line with the Salt Flat trend, takes on greater significance because of the Magnolia Petroleum Co.'s No. 1 Appling completion, in the James Hodges survey, which produced 217 barrels in one hour and eight minutes at its maximum.

The Magnolia completion is a mile and a half southwest of the Simms Oil Co., & Robert R. Penn No. 1 Manford, good for 900 barrels daily at its best, a month and a half ago. Both produce from the Taylor marl as distinguished from the Darst Creek discovery well of The Texas Co., four miles farther southwest, which yields its oil from the deeper Edwards limestone pay of the region.

Two wells of The Texas Co., its Darst Creek discovery and a north offset, are being allowed to produce approximately 1000 barrels daily. Drilling in the immediate vicinity of The Texas Co. wells was suspended under a gentlemen's agreement, about two months ago, other companies delaying development in order to avoid crude oil congestion in an area considered capable of 100,000 barrels daily production within 60 to 90 days under competitive operations.

Because of cut-up acreage and small leaseholds between the Magnolia and Simms-Penn wells, on the one hand, and The Texas Co. completions, on the other hand, efforts are being made to extend the suspension of development northeasterly in the Darst Creek territory.

Girvin District Fails To Get Big Wells

HOUSTON, Oct. 24.—Girvin district operations, 18 miles west of the Yates field, in Pecos county, West Texas, continue to show disappointing results in comparison with the nearly 50 drilling operations under way in the general area. The 12 producing wells in the territory show combined daily production of less than 1500 barrels.

A production report showing present capabilities of all wells in the district follows:

Company—Well	Bbls., Daily Prod.	Depth, Feet
Landreth & World		
University B-1	170	1641
University B-2	14	1602
Landreth Production Co. (Was Moncrief)		
University H-1	27	1717
Taylor-Link Oil Co.		
University 1	Shut in	1635
University 2	400	1630
University 3	240	1622
University 4	170	1626
Shell Pet. Corp.		
University C-1	141	961
Continental Oil Co.		
University A-1	125	996
Henshaw Bros.		
University 1	85	1030
California Co.		
Landrum 1	Shut in	1700
Independent O. & G. Co. and Rowan & Tong		
McDonald 1	83	1612

After deepening to 1620 feet, the Landreth & World B-2 well started off flowing 35 barrels hourly.

Virtually all tests in the Girvin area, with two or three exceptions, are drilled with "grasshopper" rigs or other light movable equipment.

International Derrick To Build in Houston

COLUMBUS, O.—Purchase of acreage in Houston, Tex. for a large manufacturing plant has been made by the International Derrick & Equipment Co., with headquarters here.

Five acres have been bought, fronting approximately 1000 feet on the Beaumont highway, and served by the Missouri Pacific, Southern Pacific and the Houston Belt & Terminal Railway.

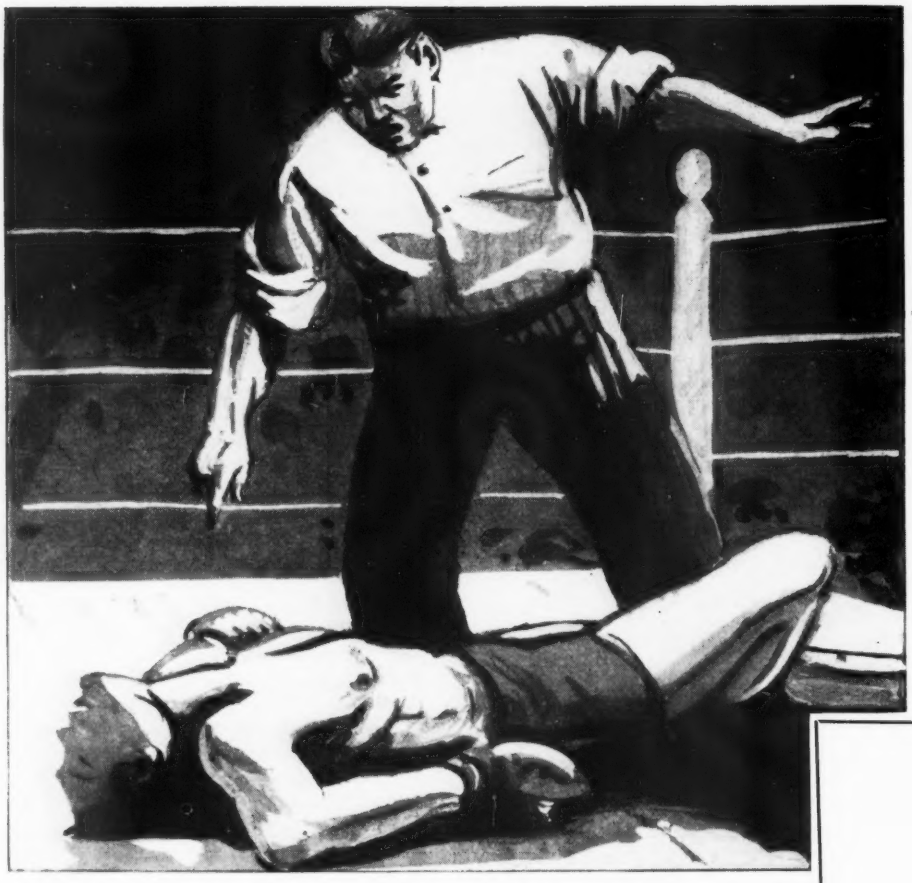
Construction of the first unit of the plant will begin shortly. The company's present Houston holdings consist of an office building, warehouse and galvanizing plant. The latter plant will be moved to form one of the units of the new plant.

Oil derricks and other oil well equipment will be manufactured in the new plant also airplane hangars, airport buildings and towers, transmission towers and substations for the electric light and power industry, radio towers, flood lights and signal bridges for railroads, and structural steel fabrications and commercial galvanizing.

Early in September the company purchased the Boykin Machinery & Supply Co., Beaumont. This firm has since been reorganized as a subsidiary of the International Derrick & Equipment Co. proper into the International Derrick & Equipment Co. of Texas, under which will come the management of both the Beaumont and new Houston plants.

Officers of this new subsidiary are: Harry M. Runkle, Columbus, O., president; B. Boykin, Jr., Beaumont, vice president and general manager; and Lucien L. Powell, Houston, secretary and treasurer.

Other plants of the company are at Columbus and Delaware, O., and Torrance, Calif. Division officers are at New York, Detroit, Wichita, Tulsa, Fort Worth, Beaumont, Houston, Shreveport, Los Angeles and Maracaibo, Venezuela, with branches and warehouses in every important oil field.



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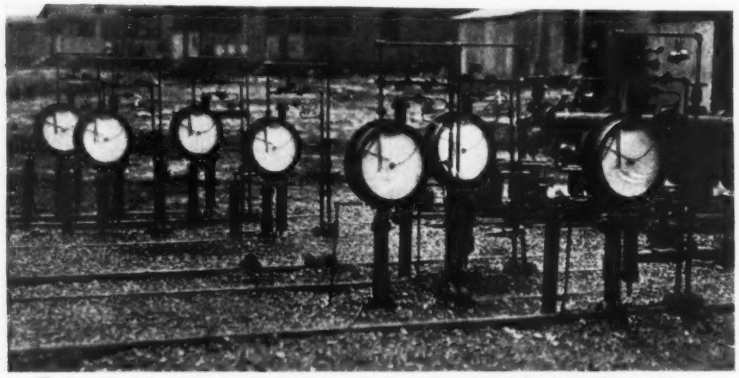
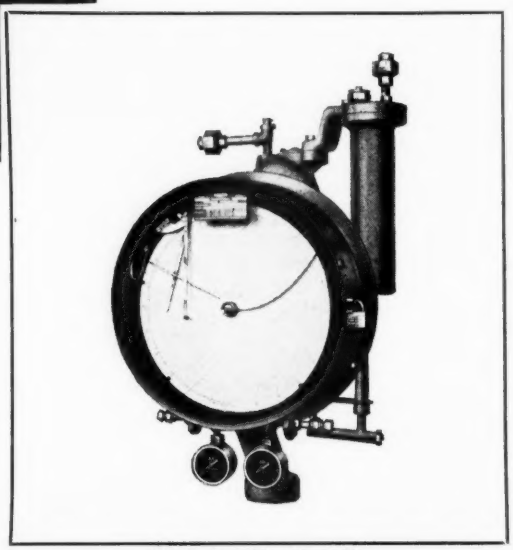
Foxboro Flow Controllers, by properly controlling the volume of gas or air to the wells, maintain uniform pressure conditions at the bottom of the well. They prevent the tendency of the well to head up; protect the wells against plugging and by-passing. Speed in repressuring can be practiced with safety.



Foxboro Flow Controllers controlling flow of gas to the wells of the Amerada Petroleum Corporation, Pascal Gas Lift Plant.



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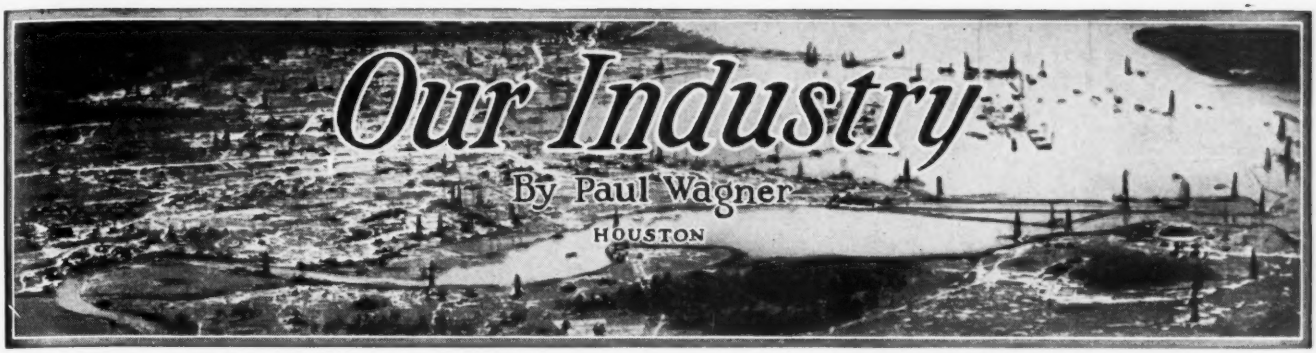


HARRY W. BELL, chief petroleum engineer of the Lion Oil & Refining Co., El Dorado, Ark., finds much of his time occupied for the present in dealing with subsurface conditions in the Winkler county, Texas, area, where the Lion took over Hendricks field producing properties previously operated by Pure Oil Co., several months ago. Mr. Bell reached the Lion organization from the Pure, where he was previously in charge of the materials department with headquarters in Chicago.

Previously, Mr. Bell was with the U. S. Bureau of Mines, at one time in charge of the Dallas division. He also served the conservation commission of the state of Louisiana as its chief supervisor before joining the Pure's production organization.

* * *

J. H. Howard, formerly a production engineer in the California organization of the General Petroleum Corp., is now chief engineer of the Weiman-Kammerer-Wright Co., Inc., manufacturers of drilling bits and other oil field equipment at Los Angeles. He was connected with the General nearly seven years prior to his recent resignation.

* * *

G. D. Terwilliger, formerly at Wichita, Kansas, for the Dixie Oil Co., Inc., direct producing subsidiary of Standard Oil Co. of Indiana in the southwest, has been transferred to San Antonio in charge of its land department. Offices are maintained in the First National Bank building. Mr. Terwilliger has been with the Dixie at Shreveport and elsewhere the last five years. Previously, he was connected with The Texas, Shell and Caddo Central companies in Shreveport territory.

* * *

Central Texas Refining Co., with plants at Luling, Minerva, Brownwood, Midland and Corsicana, has appointed O. L. Tabor as Houston district manager and will enter into the distributing branch of the petroleum industry in South Texas. A distributing warehouse is now under construction at Houston with 60,000 gallons underground tankage.

The Central Texas Refining Co., is affiliated with the Moody-Seagraves interests through the recent merger of various properties into the Cranfill-Reynolds Oil Corp., of Delaware. It embraces plants at one time operated as the Kent-Middleton Refining Co., at Corsicana and Brownwood, among others.

* * *

California oil executives were invited guests at the recent premiere of the new Will Rogers film, "They Had To See Paris," at a Hollywood theater. The picture features an oil atmosphere.

* * *

H. G. Officer of the land department of the Amerada Petroleum Corp., at Tulsa, has been in Fort Worth substituting for H. E. Marsh, Texas land department head, who was called to Marshville, N. C., by the death of his father.

* * *

Leonard W. Orinsky, chief geologist in the southern division of the California Co., at Dallas, recently returned from a vacation in San Antonio and southwest Texas. The California Co. is Rocky Mountain and Texas subsidiary of the Standard Oil Co. of California.

Harry W. Bell

* * *

G. N. Larsen, assistant to Warner Clark, southern division manager of the California Co., with Dallas headquarters, spent his vacation motoring to Rocky Mountain territory, where he was quartered before his transfer to Texas more than a year ago. Mrs. Larsen accompanied him.

* * *

Lion Oil & Refining Co., with producing headquarters at El Dorado, Ark., is extending its operations in the southwest since its recent purchase of West Texas producing properties from the Pure Oil Co. More recently, John O. Gibson, formerly of the Ohio Oil Co., at Shreveport, has been looking over the San Antonio territory for the Lion, with a view to opening an office.

* * *

H. A. Beck, assistant superintendent of the Transcontinental Petroleum Co., subsidiary of Standard Oil Co. of New Jersey, in the Cacalillao field, Panuco district of Mexico, has been spending a six weeks' vacation in Colorado.

* * *

R. Lane Griggsby, executive assistant to B. S. SoRelle, Texas division manager of the Pure Oil Co., returned to Fort Worth headquarters at the end of September from a business trip to El Paso.

* * *

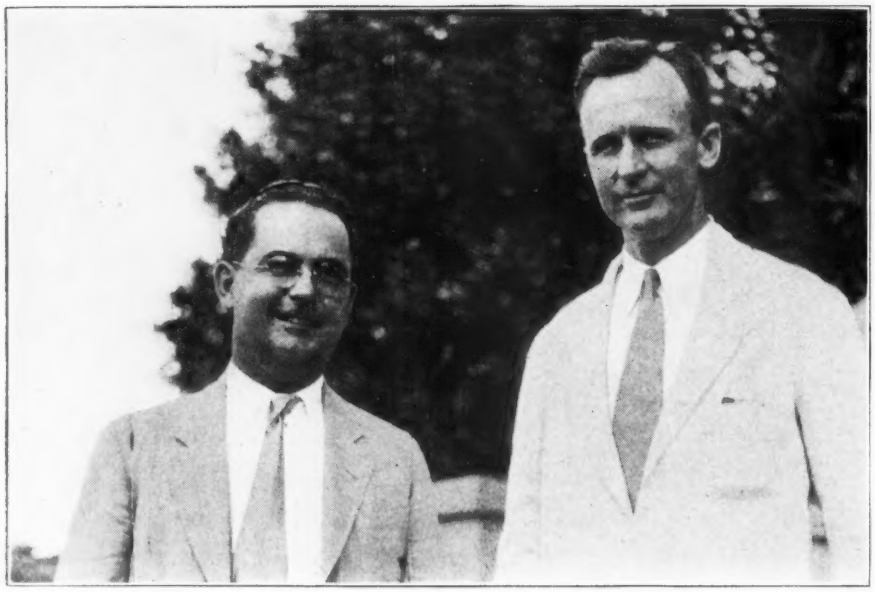
Stanley Cosden, son of J. S. Cosden, has succeeded Wayne P. Rice as plant superintendent at the Big Spring refinery of the Cosden Oil Co. Mr. Rice was transferred to the headquarters office at Fort Worth.

* * *

Charles H. Row has been elected by active members of the San Antonio district as their representative on the general business committee of the American Association of Petroleum Geologists for the years 1930-1931. Mr. Row is president of the San Antonio section of the A.A.P.G.

* * *

H. N. Seevers, Wichita Falls division chief geologist of the Atlantic Oil Producing Co., recently spent his vacation in eastern territory, includ-



Paul Louis Vaudoit and Rex G. Hamaker

ing New York. He drove his family in their car after a visit to relatives.

* * *

H. C. Easterwood has been transferred from the Fort Worth office of the Continent Oil Co., to the Abilene district. He takes the place formerly held by Joe Hemphill.

* * *

Fred A. Perrenot, who was in Venezuela for the Fitzsimmons Drilling Co., Shreveport, is back in southwest Texas, where he had been previously active for years. He is now at San Antonio.

* * *

F. B. Sorrels and A. P. Peirce are president and vice president, respectively, of the newly formed F. B. Sorrels Oil & Royalty Co., of Gonzales, Texas. B. G. Hinton is secretary-treasurer.

* * *

Walter A. Henshaw of San Angelo and C. W. Webster of Fort Worth, both widely known in the West Texas oil industry, left in September on a business trip to Sydney, Australia. They sailed from Vancouver.

* * *

Ernest Fain of the producing firm of Fain & McGaha, Wichita Falls, is now in Europe, accompanied by Mrs. Fain, on a vacation tour. Charles P. McGaha of the same firm, accompanied by his wife, recently returned from a summer spent in Canada.

* * *

C. Sprigg Miller of the land department of the Tidal Oil Co. of Texas, Fort Worth, has returned to his work after a vacation spent at his old home in West Virginia.

* * *

International Lubricants Corp., which is soon to announce completion of a modern grease plant at New Orleans, is skippered by William H. Saunders, who formerly represented the Battenfeld Grease & Oil Co., with southern Louisiana headquarters. Mr. Saunders has associated with him as sales manager, W. H. Rinkle, also at one time with the Battenfeld company and at another time sales manager of the A. J. Stevens Grease & Oil Co., at Kansas City. Both Messrs. Saunders and Rinkle are widely known in the southwestern trade.

* * *

A. T. Jergins, Long Beach oil operator, has returned home after a vacation spent in Oregon. C. M. Cotton, vice president of the Jergins Trust, recently returned to the Pacific Coast after an extended trip in Europe.

* * *

Lloyd North, formerly of the geological staff of The Texas Co., and later in charge of the reopened Houston office of Continental (Marland) Oil Co., has formed an independent operating partnership with W. J. Walton. They will operate in Guadalupe county, southwest Texas at the start.

* * *

Paul Louis Vaudoit, shown at the left in an accompanying picture, is Gulf Coastal division field engineer for the Shell Petroleum Corp., which is now increasingly active in salt dome development centering at Houston. On the right is shown Rex G. Hamaker, vice president and plant manager of the Reed Roller Bit Co., Houston, manufacturers of drilling and production equipment. Mr. Hamaker was at one time chief of the engineering department of Humble Oil & Refining Co., resigning to become connected with the Reed organization, first as chief research engineer and later in his present position.

* * *

H. A. Russell, now connected with the Delmar Oil Co., subsidiary in West Texas of the Indian Territory Illuminating Oil Co., Bartlesville, was formerly with the American Maracaibo Co.

M. J. Bonham, formerly Continental Oil Co. scout in the Texas Panhandle at Amarillo, has been transferred to San Antonio, where offices are maintained in the Milam building.

* * *

Ralph H. Cummins, vice president of the Southland Royalty Co., has returned to his Fort Worth headquarters from a combined vacation and business trip to New York City. On his return home, early in October, Mr. Cummins visited the Muskegon field in western Michigan.

* * *

Carl G. Cromwell and K. D. Harrison, San Angelo oil operators, flew to Tulsa in Mr. Cromwell's Lockheed-Vega airplane to visit the exposition.

* * *

A. F. Brann and D. D. Thomas, West Texas operators, and Maurice T. Grubb, geologist, have opened offices in the San Angelo National Bank building at San Angelo.

* * *

D. Eyoub, formerly geologist in southwest Texas and northern Mexico for Empire Gas & Fuel Co., with Laredo headquarters, has been transferred to Colombia, South America, for a few months.

* * *

D. A. Locke is now general superintendent of pipelines for the Old Dutch Refining Co., at Muskegon, Michigan. He was formerly in the pipeline department of the Natural Gas Corp., at El Dorado, Arkansas.

* * *

J. D. Thompson, Jr., for seven and a half years with the Gulf Production Co., and more recently in the Texas Panhandle territory, has opened offices at Amarillo as a consulting geologist.

* * *

Paul Bundy and Tom Nolen have opened offices in the San Angelo National Bank building at San Angelo. Mr. Bundy represents the Sequoia Oil Co., organized by Charles P. Link and William H. Dunning, Jr., of Fort Worth, in West Texas territory.

* * *

Ed S. Weaver, Tulsa, formerly connected with his brother, A. M. Weaver, drilling contractor, is now with John A. Roebling's Sons Co., wire rope manufacturers. He is working under Samuel R. Dye, who has represented the Roebling people in the Mid-Continent field for the last eighteen years.

* * *

L. V. Nicholas, of Chicago, who resigned from trade association work as president of the Independent Oil Men of America to take up oil financing and investment work, has always been an automobile enthusiast. Last month he bought himself a new Packard convertible roadster and in less than 30 days has run up over 6000 miles on the speedometer all in the regular course of his business, he says, traveling about while investigating and looking over oil jobbing properties.

Prepare to Curtail Calif. Production 30% as Result of Price Cut

By Jack N. Westsmith
N. P. N. STAFF WRITER

LOS ANGELES, Oct. 25

As a direct result of the most drastic cut in crude oil ever made at one time on the Pacific Coast, operators in the four California fields, Santa Fe Springs, Signal Hill, Seal Beach and Ventura, were preparing to put into effect a curtailment program that would reduce the state's daily average yield nearly 30 per cent.

Independent operators have almost unanimously fallen in line with the desire of major companies to reduce the production by 200,000 barrels. The one or two exceptions to those in favor of the plan are expected to see their way to sign on the dotted line during the coming week.

Standard Oil in making its announcement of the crude cut indicated that if the companies who were directly responsible for the failure of the gas conservation law agreed, to partially shut in their wells and backed up their agreement by suitable action, that the crude price would be returned to normal. One thing that is very evident is that if small refiners are able to purchase crude at 40 and 60 cents per barrel for long the Pacific Coast will witness one of the greatest price wars ever waged in refined petroleum products. Actual effect of the reduction in the offered price of crude oils will not be apparent for at least 10 days, because of contractual obligations but after that time the "fun" is likely to begin.

Operators at Santa Fe Springs and Signal Hill have already taken steps to meet the stipulations laid down by Standard Oil and they will continue the good work during the next few weeks.

Many drilling wells have been suspended, mostly by Independent operators, and wells producing less than 100 barrels of oil have been shut down entirely. With crude at even 60 cents a barrel such wells cannot pay expenses and it is therefore from this source that the initial reduction in production will be made.

Seven completions in the Clarke sands at Santa Fe Springs with average initial yields of 1625 barrels failed to measure up to 4 additions of the week before which had averages of 3209 barrels per well.

Total deep zone production in this field decreased 4715 barrels during the past week. Those wells producing at the close of the previous week showed a decline of 21,216 barrels during the past week. Clarke producers alone declined 10,789 barrels but with the new completions of the week a new high of 99,821 barrels was reached. O'Connell zone wells showed a net decline of 9845 barrels for the week.

Ten Clarke wells were pinched in slightly as a result of the recent cut in the price of crude. It is worthy of note that these wells belonged to Standard and those companies selling to Standard.

Three O'Connell wells were killed during the week preparatory to deepening to the underlying Clarke sands. Production by zones for the past week was as follows:

Zone	Production	No. Wells	Average
Nordstrom	14,440	21	688
Buckbee	20,867	38	549
O'Connell	123,675	104	1190
Clarke	99,821	56	1783
Upper zones	27,724	225	123

Standard Oil Co. continued to lead all other operators in the Clarke zone at Santa Fe Springs field with 32,454 barrels from 18 wells. Shell Oil Co. had the highest average per well by producing 12,962 barrels from 6 wells for an average of 2160 barrels.

Because of the attitude taken by the Wilshire interests to the enforcement of California's gas conservation law and the refusal of information concerning their actual production figures the following estimate is of particular interest. Wilshire's estimated production at Santa Fe Springs for the past week was as follows:

Zone	Production	No. Wells	Average
Buckbee	820	3	273
O'Connell	19,000	11	1727
Clarke	6000	4	1500

Of 223 actively drilling wells at Santa Fe Springs 25 are drilling from the O'Connell to the Clarke, 45 are drilling in the Clarke and 6 are preparing to complete in the Clarke. Union Oil Co. announced 14 new locations on their Santa Fe Springs leases. Most of the wells to be drilled at these locations will have as their objective the lower Clarke sands.

A check of drilling wells at Santa Fe Springs indicates that there will be approximately 15 wells completed in the O'Connell sand and 214 completed in the Clarke zone by the end of next May. These completions will be spread out so that the daily average for the field will not sustain any marked reduction for some time.

A survey of the Long Beach field shows that drilling operations there have been cut 25 per cent and that several Independent producers have shut down their pumping wells that have a daily production of less than 100 barrels. Active drillers were cut from 129 to 97, all of the 32 wells belong to Independent operators, a fact that is considered to be indicative of an immediate solution to overproduction in townlot areas.

More than just the small pumpers will have to be shut in if prompt results are to be obtained in curtailing production as the wells to be shut down at the present time at Long Beach would result in a daily decrease of only 1000 barrels. It is reported that Jergins Synd. and Jergins Trust will shut down pumpers now making 197 and 540 barrels respectively, and South Basin Oil Co. intends to shut down shallow producers making between 10 and 75 barrels per day, having a combined output of 257 barrels daily.

Barnsdall-Rio Grande interests have started a program intended to reduce their production in the Elwood field by at least 30 per cent. From a production of 33,158 barrels on October 23 the combine had reduced the daily yield 2100 barrels by October 25 and has hopes of reducing it to approximately 20,000 barrels within a week or ten days.

Wells adjoining the Pacific Western's tideland well No. 92 will be allowed to produce unrestrained until an agreement is worked out between the two companies, whereby an orderly production program can be followed.

New completions of the joint interests will be allowed to produce wide open until the potential production is determined, then they will be cut at least 30 per cent. The combine expects to complete its No. 1 well on tideland permit 94 within the coming week as it is now standing cemented at 3410 feet on top of the oil sand.

A production test is due on Western Gulf Oil Co.'s Hollister No. 2, a wildcat on the coast northwest of Elwood. It blew in while testing for a water shut-off and made about 4

million cubic feet of dry gas per day, until killed in preparation for the production test. As there was no evidence of oil when the well blew in operators are not very optimistic.

Ohio Oil Co. is giving out no information on its Smith well on the South Dome of the Kettleman Hills beyond the fact that it is drilling ahead at 7129 in hard sand that will not permit coring. This well was killed after being completed for over 30,000 barrels of salt water per day.

Standard will proceed with its deepening job on well No. 11P-81 on the north dome of Kettleman Hills. The hole is now bottomed at 6673 feet and will be deepened to below the 7000 foot level in search of the producing horizon found by Milham Exploration Co.'s discovery well and Continental Oil Co.'s 12-8.

Recent completions at Potrero offered little hope to other operators waiting to spud in. George F. Getty's Parker 1 is now yielding 169 barrels of clean oil on the pump and York-Lockhart has an output of 560 barrels on the compressor. Associated Oil Co. is drilling at 3700 feet in its Prairie 1 and the results will be known within the next 100 feet as the producing sand is found at about 3800 feet.

San Patricio Oil Co.'s Connolly 1, on the eastern flank of the Potrero field is bottomed at 7490 feet without penetrating anything of note. Hopes of finding another high gravity field capable of giving commercial production is rapidly diminishing as operators fail to find a trace of the oil sand on three sides of the potential field of Potrero.

Winkler Prorating To Continue

HOUSTON, Oct. 24.—Winkler county operators expect to continue prorating practice in their part of the West Texas Permian salt basin region for another six months, with approval of the railroad commission, which enforces the state's conservation laws. The present prorating period ends Nov. 5, but a majority of operators have approved continuance of the plan.

Actual production of Winkler county is now below 120,000 barrels daily, due to the inability of some of the prorating units in the field to make their allowable yields. The field as a whole has an allowable production of 150,000 barrels daily, but this production figure has not been reached for several months.

Potential production in Winkler county is rated at 263,308 barrels daily for 578 wells on 275 prorating units of 40 acres each. No tests of wells have been made for several months, however, and the prorating potential is recognized as purely arbitrary, reached under the month-to-month reduction plan of the Winkler County advisory committee of operators.

The Winkler area has now produced more than 105,000,000 barrels of crude petroleum, most of which yield has been since prorating practice was inaugurated May 5, 1928.

Old McCamey Territory Yields Big Well

HOUSTON, Oct. 24.—That the McCamey district of southwestern Upton county, West Texas, continues to have important producing capabilities was indicated when White Eagle Oil & Refining Co. completed its No. 2 Ed S. Hughes, William Teer survey No. 4, for 1930 barrels, maximum daily production. Pay was topped at 2268 feet, surface elevation 2678 feet. Total depth was 2275 feet.

The well offsets the Gulf Production Co.'s B-2 Hughes, which swabbed and flowed 30 barrels daily at 2270 feet. The wells are inside the proved territory of the McCamey field, significance attaching to the White Eagle completion mainly because it is recognized to have tapped a porous spot in the Permian lime producing horizon.

Describes Oil Outlook In the Rockies

TULSA, Oct. 26.—The Rocky Mountain area and the plains territory, from Montana to Texas, still have vast regions within their borders that have been insufficiently tested or not tested at all. This was the gist of the talk given by Max W. Ball, geologist, and president of the Milmac Oil Co., at the meeting of the Tulsa Geological Society this week. The subject of the talk was, "Future oil and gas possibilities of the Rocky Mountain region."

Mr. Ball sketched the past development from the Canadian border to the Panhandle with a familiarity born of an intimate knowledge of detail. The known producing areas and their geological relation to the regional structural features on which they appear, were first discussed. From the information furnished by these existing fields, conclusions were drawn as to the possibilities in the intervening territory.

The large intermontane basins of the Rockies have furnished the greater portion of the production of the area. Wildcat drilling however, away from the edge folds of the basins, has failed to bring in any large new fields. The reason for this has been due in part to the depth of the holes. In many cases they were not carried far enough to test completely the geologic section or the structure on which they stood, said Mr. Ball.

In these basins, according to Mr. Ball, a well should be carried through the Mississippian at least, and lower whenever possible, unless production is found above. This is particularly true of western Wyoming and eastern Idaho. There are several wells now being drilled with this intention. At Salt Creek, Wyoming, the Midwest Refining Co., has a well started which is headed for the Madison formation of the Mississippian. It will be the first well in that field to make a real test of this horizon.

Of the four large basins in Colorado, the one known as North Park seems to offer the most possibilities for pre-Cretaceous production. Most of the upper formations have been tested and deeper drilling now should be attempted. In eastern Montana and to the east of that state in the high plains country, there are many folds in the Cretaceous that have not yet been drilled.

The basins of the Rocky Mountain area have yielded most of their oil from the belt of folds around their edges. In Oklahoma the reverse is true. The largest pools of the state are down in a basin itself. Oklahoma operators are going deeper every year for their oil as they prospect farther out toward the center of the regional subsurface low. The adoption of this practice in the Rockies is not to be postponed much longer.

To cover a territory so vast in one address and do it thoroughly in a little over an hour, is a feat that few geologists would care to try. In this instance however, the infallible memory of Mr. Ball seemed to make the task a light one.

More Texas University Lands for Lease

HOUSTON, Oct. 24.—Bids have been asked by the University of Texas board of regents on prospective oil lands in Pecos, Hudspeth, Ector and Crane counties, returnable until 9:30 a.m., Nov. 7. Hudspeth county leases to be awarded under the bids call for one-eighth royalty, the others one-sixth royalty.

The lands are described as follows:

Pecos County—southeast quarter of southeast quarter, sec. 14, block 18.

Hudspeth county—secs. 1, 2, 3, 10, 12, 13, 14 and 15, block A.

Crane and Ector Counties—south half northeast quarter, and south half northwest quarter, sec. 1, block 35; south half northeast quarter, and south half northwest quarter, sec. 2; south half northeast quarter and south half northwest quarter, sec. 3; southwest quarter and northwest quarter, sec. 11; northeast quarter and northwest quarter and southeast quarter and southwest quarter, sec. 12, block 35; southeast quarter, sec. 13; northeast quarter and northwest quarter and southeast quarter and southwest quarter, sec. 14, block 35.

Completions in Texas, Week Ended October 26, 1929

NORTH CENTRAL & EAST CENTRAL

Company	Well Farm	Survey	Sec. & Blk.	Depth	Init. Prod.
Brown County					
Buder	2-Kesler	Kesler	Sec-42	1308-1328	175
Buder	3-Kesler	Kesler	Sec-42	1317-1341	432
French et al	3-Belsin	Chaddick		1295-1315	80
Lloyd	28-Collier	Smith	Blk-139	410-436	8
Smith	8-George	Chaddick		1293-1317	300
Tex-Cal	1-McIntyre	HT&B	Sec-11 Blk-1	987-989	15
Young Bros. Alexander-Woodley	12-Kilgore Bros.	McClure	Blk-152	1306-1316	10
De Mont	10-Newton	Jones	Blk-282	T.D. 167	Dry
Humble	3-Tervoren	HT&B	Sec-11	T.D. 997	Dry
Lloyd et al	1-Henderson	Henderson		T.D. 980	Dry
Callahan County					
Ducker	1-Williams	Univ.	Sec-139	T.D. 492	Dry
Moutray	1-Berry	BBB&C	Sec-106	T.D. 1503	Dry
Moutray	51-Hickman	I&GN	Sec-1	T.D. 714	Dry
Frazier et al	1-Snyder	T&NO	Sec-6	785-790	5
Ungreen-Frazier	2-Snyder	T&NO	Sec-6	793-797	4
Ungreen-Frazier	3-Snyder	T&NO	Sec-6	780-781	3
Ungreen-Frazier	4-Snyder	T&NO	Sec-6	777-784	4
Ungreen-Frazier	5-Snyder	T&NO	Sec-6	794-876	3
Ungreen-Frazier	6-Snyder	T&NO	Sec-6	794-797	2
Ungreen-Frazier	7-Snyder	T&NO	Sec-6	772-876	3
Heiss-Hart	1-Hart	D&DA	Sec-7	512-517	30
Mook Texas et al	2-Johnson	Comal Co. Sch. Ld.	Blk-83	1628-1631	12
Moutray	50-Hickman	BBB&C	Sec-149	671-684	20
Coleman County					
Anzac-Atlantic	1-Tholl Oil Fee	Martinez	Sec-12 Blk-751	T.D. 830	Dry
Epler et al	1-Roper	SP	Blk-271	T.D. 972	Dry
Stepp-Keister	1-Morris	Collard	Blk-505	T.D. 2447	Dry
Eastland County					
Tex Wa & Kirk	1-Murrell	H&TC	Sec-30 Blk-2	1330-1347	8
Page	3-Foster	H&TC	Sec-27 Blk-2	1305-1314	20
Lone Star	2-League	SP	Sec-467	3792-3800	6¾M
Anna Belle	1-Murrell	H&TC	Sec-29 Blk-2	T.D. 1335	Dry
Hill County					
Batts-Harper	1-Holderman	Sullivan		T.D. 667	Dry
Samson	1-Holderman	Stewart		T.D. 800	Dry
Harper	1-Jones	BBB&C		786-810	8
Jack County					
Harper et al	2-Egett	Hughson		3117-3154	245
Harper et al	5-Box	Hughson		3103-3114	87
Bell Drlg	1-Moore	Berryman		T.D. 505	Dry
Shackleford County					
Tannehill	26-Newell	T&P	Sec-11 Blk-11	925-926	50
Slicker	5-Mathews	ET	Sec-58	1130-1140	5

NORTH TEXAS

Company	Well Farm	Survey	Sec. & Blk.	Depth	Init. Prod.
Archer County					
Barnsdall	1-Wilson	Howard		1713-1715	42
Goldsmith-King	1-Kunkel	BBB&C	Sec-4	1152-1157	120
Humble	8-Kunkel	BBB&C		1126-1137	90
Sun	12-Kunkel	BBB&C	Sec-4	1155-1159	125
Bridwell	1-McClure	Crawford	Blk-13	T.D. 1420	Dry
Continental-Underwood	7-Ward Bros.	TE&L	Sec-1378	T.D. 1128	Dry
HiLand	1-Hausler	McCoy	Blk-16	T.D. 1200	Dry
Clay County					
American-Goldsmith	1-Byers et al.	Parker Co. Sch. Ld.	Sec-15	T.D. 1025	Dry
Cooke County					
Benson et al	1-Painter	Mikel		T.D. 3002	Dry
Shell	5-Field et al.	Stanley		T.D. 1441	Dry
Sinclair	1-Embry	ET		T.D. 2276	Dry
Texas	2-Embry	Rogers		T.D. 2617	Dry
Humble	5-Poteet	Stephens		1477-1512	204
Van Zandt County					
Pure	1-Jarmon	Nacog Doches Co. Sch. Ld.		2700-2710	1800
Wichita County					
Dixon et al	1-Logan	KWVFL	Blk-34	T.D. 1902	Dry
Mid-Cont. Hold.	1-Rhodes	Palo Pinto Sch. Ld.	Sec-8	T.D. 2105	Dry
Swanner	1-Williams et al.	Palo Pinto Sch. Ld.	Blk-15	T.D. 1282	Dry
HiLand	2-Crudup	DCSL	League-4 Blk-10	1802-1811	45
Hunter	8-Waggoner	George	Blk-1	1465-1483	20
United Prod. et al.	4-Allen et al.	KWVFL	Sec-28	1749-1752	30
Wilbarger County					
Burton	16-Waggoner	MEP&P	Sec-40	1862-1875	60
Dixie	B1-Waggoner	H&TC	Sec-4 Blk-5	2364-2439	40
Easter	A5-Waggoner	H&TC	Sec-26 Blk-4	2382-2400	10
Fain-McGaha	W18-Waggoner	H&TC	Sec-32 Blk-4	2264-2296	150
Grayback	1-Waggoner	H&TC	Sec-36 Blk-2	2385-2685	153
Lawson	A7-Waggoner	H&TC	Sec-25 Blk-4	1880-1888	140
Shell	A4-Waggoner	H&TC	Sec-43 Blk-4	2445-2448	24
Staley-Wynne	G14-Waggoner	H&TC	Sec-32 Blk-4	2307-2317	140
Dixie	C1-Waggoner	H&TC	Sec-4 Blk-5	T.D. 2465	Dry
Easter	E2-Waggoner	H&TC	Sec-22 Blk-4	T.D. 1931	Dry
Empire	C2-Waggoner	H&TC	Sec-25 Blk-4	T.D. 2410	Dry
Young County					
Willis-Gatewood et al.	1-Wellen	TE&L	Sec-631	T.D. 660	Dry
Wolf	1-Terrell Est.	TE&L	Sec-3403	T.D. 900	Dry
Chandler et al	1-Cullers	Stinnett		T.D. 600	Dry
Goldsmith et al	1-Farrow	TE&L	Sec-283	T.D. 606	Dry
Harlan-Carter	1-Barrett	Sergeant		T.D. 630	Dry
Madden-Hunt	1-Dietrich	Stell		T.D. 1158	Dry
Parks et al	6-Carpenter	Sergeant		T.D. 630	Dry
Riggs-Williams	1-Senkel	TE&L	Sec-1917	T.D. 570	Dry
United Prod	1-Kunkel	Stell		T.D. 1200	Dry
Underwood Drlg. et al.	10-Campbell	TE&L	Sec-1390	T.D. 952	Dry
Stovall	11-Stovall	Tobin	Blk-2	3980-4340	10
Shaw Inst	1-Kisinger	Conner		2492-2543	212
Wise-Jackson	2-Cullers	Hyatt		593-605	50
Bridwell	3-Cullers	Hyatt		568-580	10
Holbrook-Woods	4-Dean	YCSL	Blk-19	516-520	2
Madden-Hunt	1-Kunkel	Stell		1142-1164	20
Panhandle	2-Prideaux	T&GN		717-723	25

PANHANDLE

Company	Well Farm	Survey	Sec. & Blk.	Depth	Init. Prod.
Carson County					
Midwest Explor.	4-Cooper	I&GN	Sec-5 Blk-9	3100-3125	200
Holmes et al	2-Moore	I&GN	Sec-125 Blk-4	3040-3050	189
Gulf Prod	3-Cooper	I&GN	Sec-4 Blk-9	3130-3170	437
Empire	2-Lane	I&GN	Sec-62 Blk-4	2550-2555	39M
Gulf Prod	4-Cooper	I&GN	Sec-5 Blk-9	3120-3135	310
Skelly	18-Schaeffer	I&GN	Sec-68 Blk-4	3082-3097	550
Gray County					
Ray-Massie	5-Chapman	H&GN	Sec-51 Blk-25	T.D. 2858	Dry
Champlin	2-Jackson	H&GN	Sec-60 Blk-B-2	T.D. 4125	Dry
Gulf Prod	3-Worley	I&GN	Sec-36 Blk-3	T.D. 3163	Dry
Dye-Gillette	2-Noel	I&GN	Sec-187 Blk-3	3195-3201	145
Wilcox	32-Wilcox et al.	I&GN	Sec-61 Blk-3	2930-2937	265
Gulf Prod	2-Worley	I&GN	Sec-36 Blk-3	2952-2955	197
Champlin	3-McLaughlin	H&GN	Sec-33 Blk-B-2	2850-2855	4M
Delaney et al	8-Jackson	H&GN	Sec-88 Blk-B-2	2855-3004	5
Gulf Prod	8-Bowers	H&GN	Sec-89 Blk-B-2	3040-3057	485
McMan	6-Palmer	H&GN	Sec-31 Blk-B-2	2935-2944	300
White Eagle	1-Faulkner	H&GN	Sec-29 Blk-B-2	2810-2915	650
Hutchinson County					
Phillips	1-Johnson	A&B	Sec-35 Blk-Y	3027-3035	2252
Moore County					
Phillips	1-Wilson	T&NO	Sec-157 Blk-3-T	T.D. 3450 P.B. 3250	41M
Wheeler County					
Upham	4-Gootch	H&GN	Sec-81 Blk-23	1502-1510	28M
Murchison-Fain	3-Close	H&GN	Sec-82 Blk-23	1500-1575	40M
Anderson et al	1-Cuddeback	H&GN	Sec-18 Blk-24	1995-2012	20M

WEST TEXAS

Company	Well Farm	Survey	Sec. & Blk.	Depth	Init. Prod.
Crockett County					
Taylor-Link	3-Powell	GC&SF	Sec-52 Blk-BB	2637-2643	125
Young-Donnelly	1-Shannon	TC	Sec-42 Blk-BB	2543-2556 (6 Hrs.)	125
Glasscock County					
Sun	1-Phillips	TP	Sec-14 Blk-33	2285-2292	758
Howard County					
Moody	30-Roberts	W&NW	Sec-137 Blk-29	1318-1395	120
Ward	13-Roberts	W&NW	Sec-137 Blk-29	1330-1380	237
California	3-Roberts Lse.	W&NW	Sec-137 Blk-29	2951-2974	500
Pecos County					
Mid-Kansas & Transc.	31-Yates		Sec-34½	1120-1200 (1 Hr.)	360
Mid-Kansas & Transc.	30-Yates		Sec-34½	980-1070 (½ Hr.)	4836
California	8-Smith Lse.	TC	Sec-23 Blk-194	1568-1583 (1 Hr.)	350
California	19-Yates	TC	Sec-34 Blk-194	1112-1312 (1 Hr.)	736
California	20-Yates	TC	Sec-34 Blk-194	1108-1227 (1 Hr.)	1150
Indep.-Rowan	1-McDonald	H&GN	Sec-46 Blk-12	1605-1607 (2½ Hrs.)	340
Tower-McKenna	1-Univ.	Univ.	Sec-3 Blk-17	1860-1872 P.B. 1862	.7M
Webb	1-Webb	TM	Sec-105 Blk-OW	T.D. 472	6.7M
Crawley et al	1-Heiner	GC&SF	Sec-589	T.D. 1300	Dry
Williams et al	1-Sanford	H&GN	Sec-55 Blk-10	T.D. 1396	Dry
Perren et al	1-Peterson	H&GN	Sec-34 Blk-10	T.D. 2300	Dry
Shell	1-Jackson	H&TC	Sec-28 Blk-3	T.D. 2389	Dry
Upton County					
Texas Pacific	13-Lane	GC&SF	Sec-5	2025-2036	250
Dixie	31-Burleson	Nidiver	Sec-2	1980-2055	178

Completions in North Louisiana and Arkansas, Week Ended October 24, 1929

Company	Well	Location	Depth	Yield
Louisiana—Bossier Parish—Elm Grove				
Ark.La.Pipe Line Co.	Van Hoose B-6	36-16-12	2440	6 mil. ft. gas
Palmer Corp	Johnson No. 1	24-17-12	887	23 mil. ft. gas
Bossier Parish—Bellevue				
H. I. Morgan et al.	Weatherbee No. 1	21-19-11	1872	6 mil. ft. gas
Caddo Parish—Dixie				
Old River Oil Corp.	Sibley No. 1	15-19-14	2494	junked, aband.
Gulf Refining Co.	Hunter No. 5	17-19-14	2442	55 bbls.
Texas Company	Hunter No. 4	8-19-14	2436	80 bbls.
Ray-Dawes Drilling Co.	Hunter A-3	9-19-14	2436	150 bbls.
DeSota Parish—Mansfield				
R. O. Roy	B. Rogers No. 1	13-13-14	3015	dry, aband.
Ouachita Parish—Monroe				
Chauvin Gas Co.	West Va. No. 1	8-18-4E	2195	3mil. ft. gas
Imperial O & G Co.	Stubbs No. 10	12-19-3E	2194	4 mil. ft. gas
Magnolia Pet. Co.	Fee No. 404 Well 3	11-19-5E	2311	2mil. ft. gas
Richland Parish				
Feazel et al.	J. G. Hemlar No. 1	23-16-6E	2444	50 mil. ft. gas
Southern Carbon Co.	Binion & Sartor No. 1	21-17-6E	2468	1½ mil. ft. gas
Union Parish—Monroe				
Industrial Gas Co.	Jenney A-1	6-20-4E	2182	13 mil. ft. gas
Webster Parish—Cotton Valley				
Louisiana Oil & R. Co.	Gray No. 9	28-21-10	4658	31 mil. ft. gas
LaSalle Parish—White Sulphur				
Tunica Pet. Co.	L. & A. No. 50	16-7-2E	814	15 bbls.
East Texas—Harrison County—Waskom				
Nat. Gas Prod. Co.	Bryson No. 4	Anderson HRS	2360	1mil. ft. gas
Panola County—Bethany				
Nemours Corp	Tiller No. 5	Matthews HRS	2338	1 mil. ft. gas
Arkansas—Columbia County				
G. W. Dawley et al.	Fullenwider & Kitchen 1	12-17-22	2847	dry, aband.
Johnson County				
Ark. Nat. Gas Corp.	Bynum No. 2	12-10-24	3720	dry, aband
Logan County				
Ark. Nat. Gas Corp.	Hanna No. 1	26-7-23	4070	dry, aband.
Ouachita County—Mount Holly				
Houston Oil Co.	Wilson B-1	25-15-18	3024	dry, aband
Timberlake et al.	Criner No. 1	26-14-18	2900	dry, aband.
Ouachita County—Smackover				
B. F. Foster	Murph No. 1	35-15-16	2040	75 bbls.
J. D. Reynolds	Fee No. 2	27-15-15	2043	15 bbls.
Skelly Oil Co.	Woods No. 4	34-15-15	2029	288 bbls.
Simms Oil Co.	E. Johnson No. 3	34-15-15	1986	60 bbls.
Union County—Smackover				
Ark. Nat. Gas Corp.	Alphin No. 5	11-16-15	1980	5 bbls.
E. M. Jones	Henry Murphy No. 2	2-16-15	2100	salt water, abd.
Pure Oil Co.	Merriweather No. 1	6-16-15	2067	5 bbls.

Completions in Oklahoma and Kansas, Week Ended October 26, 1929

OKLAHOMA

Coal County

Company	Well No.	Location	Depth	Init. Prod.
McGinley-Sigler	1	NE SW SE 7-2-8 E	T.D. 3016	Dry

Cotton County

Company	Well No.	Location	Depth	Init. Prod.
Shasta	5	SWc NW NE NE 2-2-10 W	2153-2179	100

Comanche County

Company	Well No.	Location	Depth	Init. Prod.
Cooper	1	C SE SW 3-3-10 W	1446-1457	7

Creek County

Company	Well No.	Location	Depth	Init. Prod.
Devonian	1	SE NE NE 35-15-7 E	2639-2717	40
Skelly	1	SWc SE SW 10-15-8 E	3785-3812	40
Carter	10	NEc 18-16-9 E	2680-2728	75
Texas	9	NE SW SW 6-17-7 E	2400-2434	15
Pioneer	1	C NW SE 18-17-10 E	2188-2232	25
Foster	1	SW SE NW 25-19-8 E	2380-2396	50
Sherry et al	2	C SW NE 28-19-9 E	2242-2257	3⅜M
Sooner	1	NWc SE SE 31-18-11 E	T.D. 2006	Dry
Wood	1	NEc SE 19-19-9 E	T.D. 1100	Dry

Hughes County

Company	Well No.	Location	Depth	Init. Prod.
Sinclair	1	SWc SE 5-6-8 E	2933-2975	110

Jefferson County

Company	Well No.	Location	Depth	Init. Prod.
McGinley-Sigler	11	SWc NW SE NE 20-7-5 W	T.D. 560	Dry

Kay County

Company	Well No.	Location	Depth	Init. Prod.
DeCamp et al	2	C NE NE 25-28-1 W	740-1060	¾M

LeFlore County

Company	Well No.	Location	Depth	Init. Prod.
LeFlore County	2	NEc SW SW SE 28-7-26 E	1555-1805	1½M

Lincoln County

Company	Well No.	Location	Depth	Init. Prod.
Billingslea et al	1	SE NE NE 28-17-6 E	T.D. 3481	Dry
Continental	1	NW NE NW 36-17-3 E	3922-3974	8½M

Muskogee County

Company	Well No.	Location	Depth	Init. Prod.
Arthur	9	SWc NE NE 34-15-18 E	817-847	½M
Aggas	1	SEc NE SW 28-16-15 E	1407-1433	OWD 7
Newport et al	1	NEc SW NW 13-13-18 E	T.D. 807	Dry
Lightner et al	1	NWc NE 30-14-16 E	T.D. 1414	Dry
McCullough et al	1	SEc SW SW NE 13-14-18 E	T.D. 1098	Dry
Summers et al	6	SEc NW 28-15-16 E	T.D. 1602	Dry
Lovelace et al	1	NW SW NW 35-15-18 E	T.D. 1098	Dry
Mack Drlg	1	C SW NE 35-16-15 E	T.D. 1800	Dry

Okfuskee County

Company	Well No.	Location	Depth	Init. Prod.
Robinson	1	NW NE NW 2-10-9 E	1514-1421	12
Havell et al	1	SWc SE 23-11-11 E	1592-1644	75
Milmac	1	SEc SW NE 27-12-12 E	3314-3372	250

Okmulgee County

Company	Well No.	Location	Depth	Init. Prod.
Getzendamer et al.	6	CWL NW SW 29-15-11 E	2557-2577	15

Osage County

Company	Well No.	Location	Depth	Init. Prod.
Okla. Power & Water	123	SEc SW 4-20-10 E	365-375	⅛M
Okla. Natural	1738	SEc 6-21-12 E	1325-1327	1½M
Silurian	56	NW NE NW 17-23-12 E	1501-1557	35
McCune-Wormser et al.	3	SW NE NE 15-24-8 E	2640-2645	150
Peters-Prod. & Refs.	4	CSL SW 22-27-11 E	1670-1692	200
Okla. Power & Water	120	C SW 4-20-10 E	T.D. 2660	Dry
Wrightsman	1	NWc SE 32-22-8 E	T.D. 2786	Dry
Midco	1	NEc NW 13-22-9 E	T.D. 2551	Dry
Elliott-Smith	2	NE SE SE 33-22-11 E	T.D. 2132	Dry
Oliphant et al	1	NEc SW 13-24-6 E	T.D. 2726	Dry
Maxwell	4	SW NW SW 5-24-11 E	T.D. 1824	Dry
Peters-Prod. & Refs.	1	SEc 19-26-7 E	T.D. 3120	Dry

Payne County

Company	Well No.	Location	Depth	Init. Prod.
Home	1	NWc SE 13-18-5 E	T.D. 3720	Dry

Pawnee County

Company	Well No.	Location	Depth	Init. Prod.
Hay et al	3	NWc SW 26-20-9 E	2144-2174	125
Adamson Jr.	7	SWc NE 25-21-8 E	1115-1127	18

Pontotoc County

Company	Well No.	Location	Depth	Init. Prod.
Delaney-King	1	SEc NE 29-5-8 E	841-855	160
American	3	NEc SW 19-5-5 E	2337-2385	700
Transcontinental	3	SE NW NW 19-5-5 E	2299-2360	30
McMan	1	NEc NW 30-5-5 E	2317-2477	60
Benedum-Trees	1	NE SE NW 31-5-5 E	2482-2680	50
Denver Prod. & Ref.	1	NEc 36-5-4 E	2570-2615	75

Pottawatomie County

Company	Well No.	Location	Depth	Init. Prod.
Magnolia	1	NW NE NE 21-7-4 E	3620-2695	500
Magnolia	2	SWc 15-7-4 E	510-4009	510

Seminole County

Company	Well No.	Location	Depth	Init. Prod.
Carter	1	NE SW SW 11-9-6 E	4100-4121	1255
Magnolia	1	SWc 18-7-7 E	3163-3166	15M
Gypsy	4	NW NE NE 11-7-6 E	3063-3087	1390
Carter	5	NW SW NE 23-7-6 E	3163-3205	195
Carter	1	SE SW NE 7-6-8 E	2877-3060	60
Carter	2	SEc SW 7-6-8 E	4088-4178	25
Independent	14	SW NW NW 23-7-6 E	T.D. 3281	Dry

Stephens County

Company	Well No.	Location	Depth	Init. Prod.
Pace et al	4	NEc NW NW SW 18-2-7 W	T.D. 1482	Dry
Tooey-Long	1	NWc SW NW NW 11-3-5 W	T.D. 1100	Dry
Ellis Drlg	8	SEc SW NW 34-1-8 W	1712-1714	6
Magnolia	25	NEc NW SW 34-1-8 W	1839-1859	33

Tulsa County

Company	Well No.	Location	Depth	Init. Prod.
Johnson et al	1	NE NW NW 22-16-13 E	T.D. 2105	Dry

Wagoner County

Company	Well No.	Location	Depth	Init. Prod.
Buzzard et al	1	NEc SE 33-19-16 E	T.D. 735	Dry

Woods County

Company	Well No.	Location	Depth	Init. Prod.
Peerless Prod	1	C SW SE 14-28-16 W	T.D. 1500	Dry

KANSAS

Barber County

Company	Well No.	Location	Depth	Init. Prod.
Allison-Fitzwilliams	1	NW SE SE 9-30-12 W	T.D. 4673	Dry

Butler County

Company	Well No.	Location	Depth	Init. Prod.
Lewis Prod	1	SEc 18-27-7 E	T.D. 3204	Dry
Travis et al	1	SEc 21-25-3 E	T.D. 3190	Dry
Alladin	1	SEc NW 24-27-3 E	3068-3078	50

Cowley County

Company	Well No.	Location	Depth	Init. Prod.
Shawver et al	2	SE NW NW 15-31-3 E	T.D. 3160	Dry

Elk County

Company	Well No.	Location	Depth	Init. Prod.
Minnehoma et al	3	C NW SW 3-31-9 E	1930-1952	1150

Ellis County

Company	Well No.	Location	Depth	Init. Prod.
Phillips	1	SEc NW 9-13-19 W	3592-3609	125

Greenwood County

Company	Well No.	Location	Depth	Init. Prod.
Empire	4	NW SE NW 9-25-13 E	1509-1534	120
Simmons et al	2	NW SW SW 22-23-11 E	1940-1980	250
Sullivan et al	1	SWc SE 14-23-11 E	T.D. 1940	Dry

Harvey County

Company	Well No.	Location	Depth	Init. Prod.
Shell	1	NE SW SE 11-23-2 W	T.D. 3005	OWD 90

McPherson County

Company	Well No.	Location	Depth	Init. Prod.
McPherson	1	SWc 8-18-3 W	T.D. 3620	Dry

Sedgwick County

Company	Well No.	Location	Depth	Init. Prod.
Davis	1	NEc 14-27-1 E	T.D. 3425	Dry
Barnsdall	1	NE NW NW 22-26-2 E	T.D. 3290	Dry
Plains	1	NW SE SW 15-26-2 E	T.D. 3221	OWD Dry
Deal et al	1	NE SW SW 15-26-2 E	T.D. 3251	Dry
Bu Vi Bar et al	1	SWc NE 7-26-1 E	3030-3284	45

Woodson County

Company	Well No.	Location	Depth	Init. Prod.
Harper	2	SWc NE 28-23-14 E	1639-1651	2

Completions in California, Week Ended October 19, 1929

Long Beach

Company	Well No.	Location	Depth	Init. Prod.
Hancock Oil Co.	Signal 25	....	4728	350
James Oil Co.	No. 4	....	6865	550
McCrate A. N.	Neete 3	....	7237	1000

Santa Fe Springs

Company	Well No.	Location	Depth	Init. Prod.
Allison Synd	No. 1	....	7015	1750
General Pet. Corp.	S. F. 145 E	....	6950	1368
General Pet. Corp.	S. F. 234	....	7692	2500
General Pet. Corp.	Jalk 114	....	8095	1500
Rhode, O. J.	S. F. 1	....	7203	1740
Shell Oil Co.	G. H. N. 22	....	7835	2500
Shell Oil Co.	Slusher 16	....	7900	945
Shell Oil Co.	Slusher 18	....	7921	2129
The Texas Co.	Matern 2 No. 8	....	7920	3265
Union Oil Co.	Bell 48	....	6845	825

Richfield

Company	Well No.	Location	Depth	Init. Prod.
Continental Oil Co.	Santa Fe 2	....	4454	118

Seal Beach

Company	Well No.	Location	Depth	Init. Prod.
Continental Oil Co.	Bixby 29	....	5500	1350
Continental Oil Co.	McGrath-Selover 6	....	5335	63

Round Mountain

Company	Well No.	Location	Depth	Init. Prod.
Shell Oil Co.	Jewett 2-8	....	1620	250

Maricopa

Company	Well No.	Location	Depth	Init. Prod.
North Amer. Cons.	Sunset 4	....	3313	975

Ventura Avenue

Company	Well No.	Location	Depth	Init. Prod.
Shell Oil Co.	Gosnell 32	....	7686	502

New Field Operations in Oklahoma, Kansas, North, North Central, East Central, Panhandle and West Texas, Week Ended October 26, 1929

OKLAHOMA

Carter County

Company	Well No. & Farm	Location	
Magnolia	4-Gill	SW NE SE 23-1-3 W	
Magnolia	2-Martin	NE NW SE 23-1-3 W	
Magnolia	3-Hightower	SW NW NE 30-1-3 W	

Cotton County

Company	Well No. & Farm	Location	
Shasta	6-Slogan	NEc NW NE NE 2-2-10 W	
Shasta	7-Slogan	SEc NW NE NE 2-2-10 W	
Baldwin-Sultan	5-Rhone	NEc SW SE SE 35-1-10 W	

Creek County

Company	Well No. & Farm	Location	
Darby	3-Johnson	SEc SW NE 21-16-8 E	
Tidal	12-Tiger	CSL NE 17-17-7 E	
Bailey	7-Fulsom	CWL NW SW 13-17-10 E	
Curtis et al	1-Littlehead	SWc NW NW 20-17-10 E	
Hemlock	1-Fulsom	SWc 35-17-10 E	
Sooner	5-Burner	C SW SW 12-17-11 E	
McCready et al	3-Hardridge	NWc SW SE 30-17-11 E	
Regal	10-Barnett	CEL SW SW 13-18-11 E	OWD
Keaton et al	1-Drew	SWc NW NW SW 32-18-11 E	
Lynch et al	1-Brown	NEc SW NW 4-18-12 E	OWD
Pioneer	5-Morgan	CWL SW NE 15-19-9 E	
Sherry et al	2-Narharkey	NEc NW 24-19-9 E	

Grady County

Company	Well No. & Farm	Location	
Magnolia	4-Harrison	SE NE NE 28-3-5 W	OWD

Grant County

Company	Well No. & Farm	Location	
Continental	1-Forsythe	CWL NW NE 2-27-3 W	
Tidal	1-Secatt	NEc SW 35-28-3 W	
Consolidated	1-Fox	C NE SE 34-28-3 W	

LeFlore County

Company	Well No. & Farm	Location	
LeFlore County	3-Cricklin	CWL SE SE SE 28-7-26 E	

Muskogee County

Company	Well No. & Farm	Location	
Wilson-Barnes	1-Kelly	SWc NW SW 13-13-18 E	
Jolly et al	2-Townlot	NWc NE SW NW 35-15-18 E	

(*Continued on Page 79*)

New Field Operations in Oklahoma, Kansas, North, North Central, East Central, Panhandle and West Texas, Week Ended October 26, 1929

(Continued from Page 78)

Okfuskee County

Company	Well No. & Farm	Location	
Moore et al	2-Autry	SWc NE 12-10-11 E	
Burke-Greis	2-Unallotted	SWc NE SW 36-11-9 E	OWD

Oklahoma County

I. T. I. O. et al	10-Trosper	SE SW SW 13-11-3 W	
I. T. I. O. et al	3-Krager	SE NE NE 23-11-3 W	
I. T. I. O. et al	7-Bodine	SE NW SE 24-11-3 W	

Osage County

Okla. Natural	1741	NWc NE SW SW 5-21-12 E	
Barnsdall et al	6	NW NE SE 22-22-11 E	
Brown et al	1	NWc NE 30-24-8 E	

Pawnee County

Purser et al	1-Miller	SE NE SE 20-20-10 E	

Payne County

Shaffer	1-Searcy	SEc SW 4-18-5 E	

Pontotoc County

Delaney-King	2-Smith	NE SE NE 29-5-8 E	
Tidal	10-Dawson	SWc NW 28-5-8 E	

Pottawatomie County

Payne Drlg	1-Bullock	SEc NE 22-6-3 E	
Magnolia	1-Hilton	NE NW NW 22-7-4 E	

Seminole County

Hubbell-Graham et al.	1-Dobbs	NWc SE 8-9-5 E	
Magnolia	5-Reed	NW NE SW 4-8-7 E	
Magnolia	1-Cudjo	NEc 24-7-6 E	
Signal	5-Bond	SE SW NE 13-6-7 E	
Sinclair	1-Cully	SW NW NW 13-5-7 E	OWD
Mid-Continent	17-Fleet	NE SW SE 7-5-8 E	

Stephens County

Magnolia	6-Russell	SWc SE 25-1-9 W	OWD
Ven-Mex et al	2-Thompson	SEc SW 35-1-8 W	
Pelwin	1-Pielsticker	NWc NE SE NE 5-2-8 W	

Tulsa County

Byrne-Green	2-Boulton	SWc SE NE 28-18-14 E	
Murray et al	1-McIntosh	SWc 29-19-14 E	

KANSAS

Barber County

Allison-Fitzwilliams	1-Kumberg	NWc SE 2-30-12 W	

Butler County

Alladin	1-Chance	SEc 14-27-3 E	
Empire	92-Koogler	NW SW NE 20-26-5 E	
Empire	91-Koogler	NW NE SW 20-26-5 E	
Empire	90-Koogler	SE SW NE 20-26-5 E	
Empire	18-Houston	SW NE SW 19-26-5 E	
Empire	19-Hess	NE SE NW 18-26-5 E	

Chase County

Selby	3-Hartley	NEc SE 35-22-9 E	

Chautauqua County

Griffin-Bell	6-Oliver	CWL SE 1-32-10 E	

Coffey County

Shaffer-Howell	1-Leavering	CSL SE 12-23-14 E	

Ellis County

Barnsdall	2-Johnson	SE NE SW 9-13-19 W	

Graham County

Gulf Coast Drlg. et al.	2-St. John	CNL S½ SE 27-8-25 W	

Greenwood County

Derby et al	1-Albans	SW SE SE 8-24-13 E	
Walton	1-Barnes	SW NW NW 7-24-13 E	
Sheedy et al	3-Sharp	NW NE SE 5-24-13 E	
Houston-Oklahoma	1-School	SWc NE 11-24-12 E	
Marshall et al	1-Ott	SE SW SW 12-24-11 E	

Rice County

Independent	1-Mezger	SWc NE 21-20-10 W	

TEXAS

NORTH CENTRAL & EAST CENTRAL

Brown County

			Survey
Baker Bros	3-White Hrs.		Honeycutt
Smith	10-George		Chaddick
French et al	1-Hayes	Sec-43 Blk-41	Neill
Tex-Cal	2-Martin Hrs.	Sec-11	HT&B
Lloyd	29-Collins	Blk-139	Smith
Curry	1-Prater	Blk-145	Swain
DeMont	11-Newton	Blk-282	Jones
Amer. Maracaibo	2-Cross	Blk-623	Honeycutt
Humble	1-Martin	Sec-11	HT&B
Young Bros.-Alexander-Woodley	13-Kilgore	Blk-152	McClure

Callahan County

Driskell et al	1-Finley	Sec-67	BOA
Heiss-Hart	2-Hart	Sec-7	D&DA

Coleman County

Tower-McKanna	7-Crowder	Blk-483	Woods
Jamison et al	1-Hutchins	Sec-11	GH&H
Sawyer et al	1-Moss	Blk-70	TCT Co.
Elrod et al	5-Hass	Sec-71	GH&H
Diana	1-Morris	Sec-27 Blk-722	Webber
White Eagle et al	2-McAdams	Blk-243	Shanks
Roverts	1-Rass	Blk-301	Beall

Eastland County

Page	3-Lyerla	Sec-27 Blk-2	H&TC
Lone Star	1-Palmer	Sec-477	SP
Lone Star	3-Storm	Sec-470	SP

Hill County

Harper-Laston	3-Jones		McDonald

Jack County

Gwinn et al	1-Franklin		Ash
Stemp et al	1-Knox		SA&MG

Company	Well No. & Farm	Location	
Brox et al	1-Morris		Vandiner
Panhandle	2-Damire et al.		Hughson
Harper et al	6-Box		Hughson
Harper et al	8-Box		Hughson
Shaw	3-Box		Hughson

Shackleford County

Campbell et al	1-Hennessey	Sec-68 Blk-13	T&P
Owens et al	2-Davis	Sec-15 Blk-14	T&P
Mutray	1-Nail	Sec-40	ET

Stephens County

Grace et al	1-Allison	Sec-3243	TE&L
State	5-Sykes	Sec-84 Blk-6	T&P
Universal O & G Co.	1-Corbett	Sec-1070	TE&L
Freeland	1-Wagley	Sec-26 Blk-7	T&P
Hickock Prod. & Dev.	3-Hamil	Sec-6	LAL

NORTH TEXAS

Archer County

Peacock-Tedford	2-Williams		Swing
Gilliland- Roser	2-Donnell	Blk-14	Crawford
United Prod	2-Kunkel		Stell
Perkins-Cullum	1-Lauster		SP
Stumpf	1-Ward		BBB&C
Consolidated	1-Wright	Sec-2435	TE&L

Clay County

Art et al	1-Byres	Sec-16	Parker Co. Sch. Ld.

Cooke County

Rutcliffe-Buttles	1-Jones		Arocha
Kewanee	1-Pennbroke		Pennbroke
Kewanee	1-Franklin		Rodriguez
Coline	4-Huggins		SP

Foard County

Shell-Fain-McGaha	1-French	Sec-3	GC&SF

Montague County

Pace et al	1-Cobb		Grimes

Wichita County

Stump et al	1-Waggoner	Blk-13	GH&H
Panhandle	11-Burnett		Meade
McCarty	1-Kemp et al.	Blk-45	KWVFL
Hobbs	1-Munger	Blk-31	KWVFL
Merrick Drlg. et al.	1-Fisher	Sec-24	Collins
Litchfield et al	1-Hursh	Blk-6	Cherokee Co. Sch. Lds.

Wilbarger County

Zenith	1-Dill	Sec-82 Blk-14	H&TC
Fain-McGaha	AA4-Waggoner	Sec-18 Blk-4	H&TC
Empire	A18-Waggoner	Sec-30 Blk-4	H&TC
Shaw	E6-Waggoner	Sec-18 Blk-4	H&TC
Fain-McGaha	DD3-Waggoner	Sec-39	MEP&P
Hammond	1-Dill	Sec-82 Blk-14	H&TC

Young County

Imperator	1-White		Criswell
Scott-Nance	6-Paynes		Smith
Shaw Inc.	1-Pickard		Woolley
Baker-Pardee et al.	1-Donnell		Bellah
Consolidated	1-Deitrich		Stell
Wise-Porterfield	2-Cullers		Stinneth
Wise-Jackson	3-Cullers		Hyatt
Bridwell	4-Cullers		Hyatt
Long	7-McCaghren	Sec-1367	TE&L
Inman-Lisle	1-Jones	Sec-273	TE&L
Parks et al	2-Cullers		Stinneth
Nix-Stumpf	1-Bailey	Sec-165	TE&L
Perkins	1-Patterson	Sec-185	TE&L
Gwynn et al	1-Weishman	Sec-173	TE&L

PANHANDLE

Carson County

Empire	1-Thorp	Sec-20 Blk-T	AB&M
Stubblefield-Shell	1-Block	Sec-111 Blk-4	I&GN
Empire	2	Sec-2	BS&F
Empire	3-Deahl	Sec-23 Blk-Y-2	TT

Gray County

Adams	4-Morse	Sec-3 Blk-26	H&GN
Guernsey	1-Variman	Sec-175 Blk-3	I&GN
Travis-Reiger	1-Mackie	Sec-114 Blk-B-2	H&GN
Big Gray Oil Co.	1-Saunders	Sec-40 Blk-3	I&GN

Wheeler County

Martin-Debous	1-Close	Sec-83 Blk-23	H&GN
Upham	5-Gootch	Sec-81 Blk-23	H&GN
Magnolia	2-Laycock	Sec-10 Blk-27	H&GN
Upham	1-Cuddleback	Sec-2 Blk-24	H&GN

WEST TEXAS

Garza County

Pandem	1-Stoker	Sec-32 Blk-5	GH&H

Howard County

Pure	2-Hooks	Sec-140 Blk-29	Univ.
Goodley	2-Hooks	Sec-140 Blk-29	Univ.

Pecos County

Rector et al	1-Love	Sec-106 Blk-8	H&GN
Mazda	1-Univ.	Sec-103 Blk-11	H&GN
Landreth-Denning	1-McDonald	Sec-40½ Blk-12	H&GN
Landreth	1-Cunningham	Sec-32 Blk-11	H&GN
Landreth et al	1-Peters	Sec-31 Blk-11	H&GN
Landreth Prod	1-Univ.	Sec-13 Blk-18	Univ.
Corzelius et al	1-Union Land	Blk-11	H&GN

Upton County

Pure	2-Hughes	Sec-4	Teeves
Dixie	32-Burleson	Sec-2	Nidiver

Ward County

Gulf Prod	7-Brien	Sec-22 Blk-F	GMMB&A

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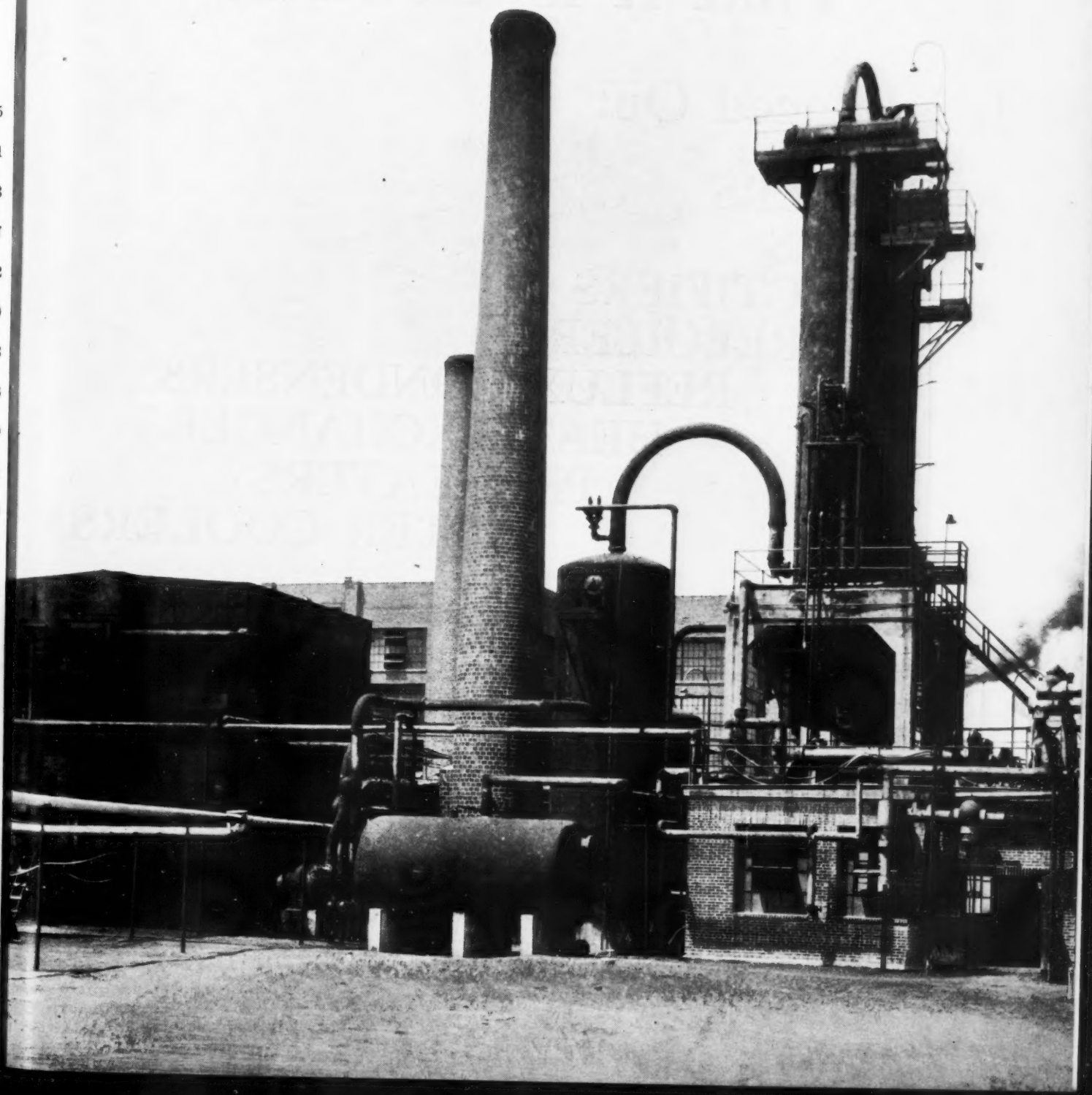
Refining
and
Natural Gasoline



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Here Are Ten Methods to Modernize Old Shell Still Batteries

By W. E. Perdew*

SOONER or later every refiner is confronted with the desirability, if not necessity, of either remodeling or replacing his crude oil distillation equipment.

Physical condition of present equipment, including tail house, pump house, run-down and other lines; cost of fuel; crude supply; market requirements for different products; the present and probable future overall picture of the refinery, and the position of the crude oil distillation equipment in this picture; other capital investment requirements; and amount of money available for capital expenditures are features which differ with each refiner, and all of which should be carefully considered by the refiner before he decides whether he should remodel or abandon his present crude oil distillation equipment.

This brief paper deals with the remodeling and improving of present equipment, and the flow sheets of a number of remodeled jobs are given as typical illustrations of what can be done.

Real operability, complete yields in the tank car of the most valuable products, and per cent of time on stream at full efficiency are primary considerations with all types of distillation equipment. While contributing to the red figures, or to the smallness of the figures on the profit side of the monthly operating profit statement of the refinery, fuel costs, labor costs and power costs by themselves never have broken any refiner. Repair and maintenance costs are important but their effect on earnings is reflected in per cent time on stream at full efficiency more than in labor and material costs.

W. E. Perdew

If the general physical condition of present equipment, the cost of fuel per B.t.u., and the bank balance justify the expenditures, a shell still or shell still and pipe still hook-up can be made just as efficient in respect to fuel consumption and just as automatic in respect to operation as can any tube still—bubble tower hook-up.

Fuel consumption per barrel of oil run can be reduced by:

(a) The proper insulating and weather proofing.

(b) Installation of efficient heat exchangers of ample size in vapor lines or their equivalent, and on the bottoms draw off line.

(c) Putting economizers in the smoke tunnels or stacks.

(d) And welding 4-inch fire tubes in the stills. It is obvious that any improvements of this nature also increase the capacity of the battery.

A liberal application of temperature recorders and regulators and their adjuncts, of liquid level controls and of flow controllers will make the operation automatic.

It should be noted that a new shell still battery or shell still-pipe still hook-up in which all these heat ex-

*Winkler-Koch Engineering Co., Wichita, Kans.

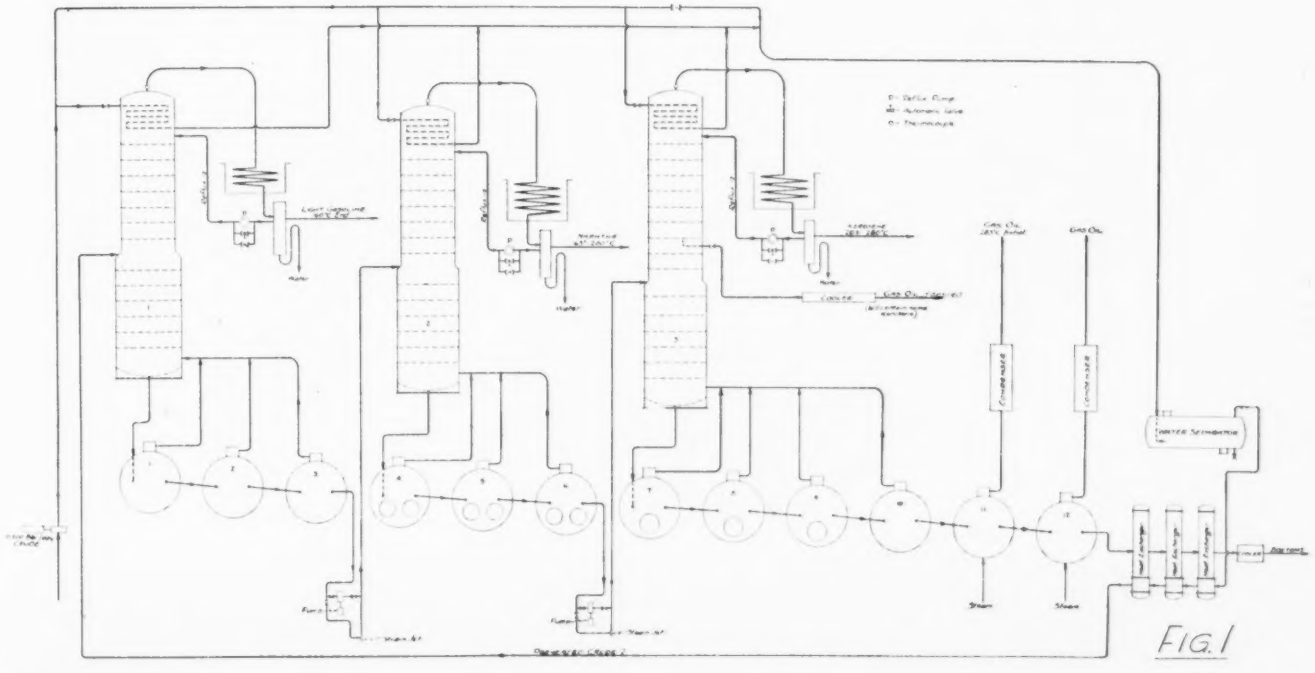
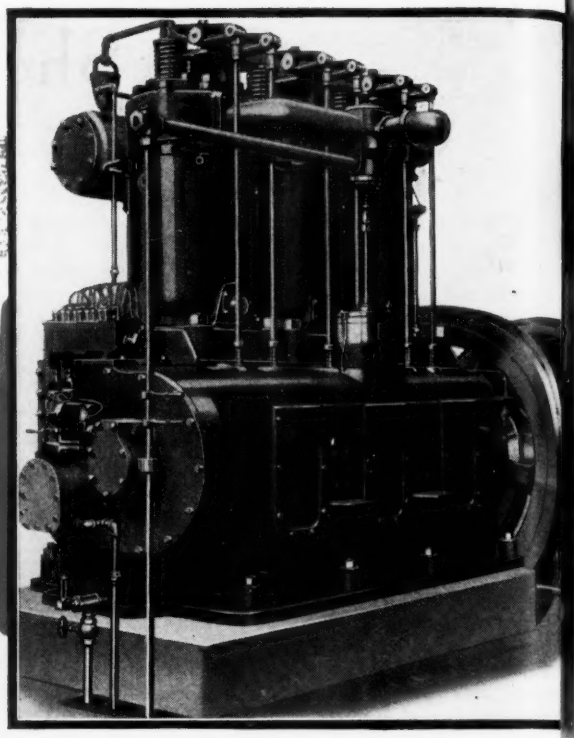


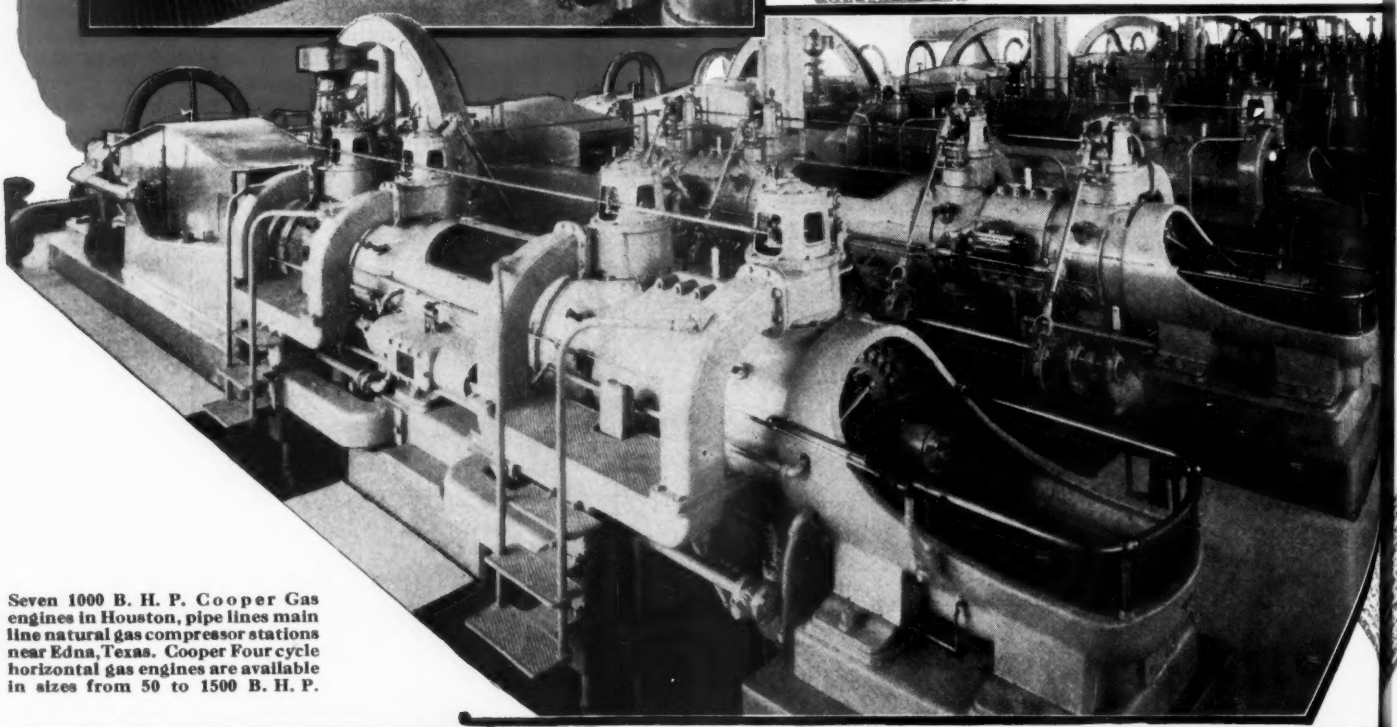
FIG. 1

A TRIPLE



Eighteen Bessemer Type-10 two cycle gas engines in one of Carter Oil Company's gasoline plants in the Seminole field. Bessemer two and four cycle engines are built for every oil and gas field service in sizes from 12½ to 200 H. P.

A Hope 200 H. P. three cylinder vertical gas engine driving an alternating current generator in oil field service. Hope vertical engines are now built in sizes from 80 to 540 H. P. by the Cooper-Bessemer Corporation for every power service.



Seven 1000 B. H. P. Cooper Gas engines in Houston, pipe lines main line natural gas compressor stations near Edna, Texas. Cooper Four cycle horizontal gas engines are available in sizes from 50 to 1500 B. H. P.

COOPER

ALLIANCE

COOPER - BESSEMER - HOPE

THE *Cooper-Bessemer Corporation* inherits all of the specialized knowledge, all of the rich experience gained by Cooper in the gas field, Bessemer in the oil field, Hope in the power and lighting field. Joined together, these three factors form a triple alliance for greater service, greater research and development, greater reliability and economy in power production.

Ninety-six years ago two Cooper brothers built their first horse-sweep for driving the Cooper cupola at Mt. Vernon. Then came throttling steam engines, locomotives, farm engines, Corliss engines. The first Cooper 4-cycle horizontal gas engine entered compressor service in West Virginia. It is still in constant service, and Cooper has become the leader in furnishing power requirements for the transmission of natural gas through pipe lines. Cooper engines are also in service in refineries, in gasoline plants and in electric plants. In addition, Cooper has been building Diesels.

Thirty years ago the first Bessemer oil field engine entered service in Pennsylvania. Since then Bessemer has been the leading builder of 2-cycle horizontal gas engines for drilling, pumping, pressure work, pipeline pumping, gasoline plants, booster stations, and for power service in refineries. In addition, Bessemer has been an outstanding builder of Diesel oil engines.

Twenty-nine years ago the first Hope 4-cycle vertical gas engine was installed. Twenty-eight years later the Hope was acquired and still further improved by Cooper. Each succeeding year has added to the high prestige of this engine for auxiliary power in main line and booster stations — in gasoline recovery plants — for power and lighting plants — in divers industries.

With these three lines combined and standardized, you can now get a Cooper, a Bessemer or a Hope that meets your conditions exactly.

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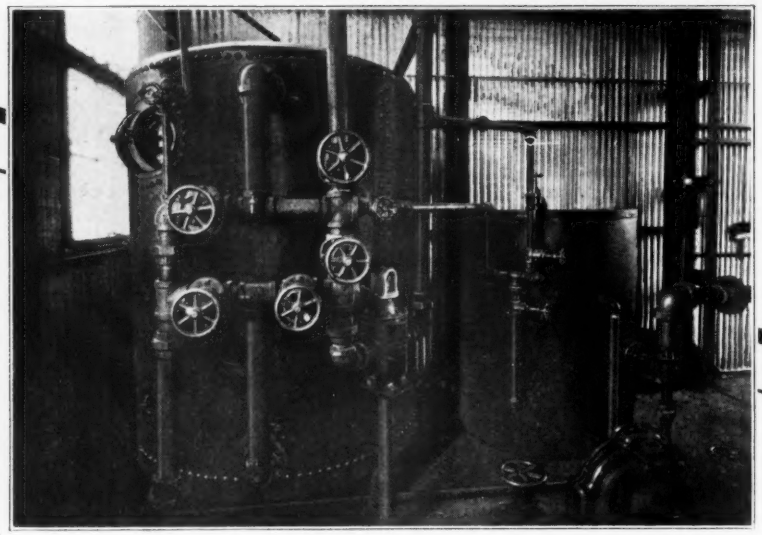
Your cooling water — may be the most troublesome and expensive part of your plant



Natural Gasoline Plants

You don't have the opportunity to choose your water supply at a gasoline plant. You take it "as is." And generally "as is" means "hard water"—"muddy water" —"limited water."

If this is the case, and it generally is, you can rest assured that a water softener will be the best paying investment you ever made. You know what hard water will do to your cooling coils by depositing scale, making adequate cooling a problem. In your oil engines it's the same trouble, coating the cylinder with scale and preventing adequate cooling. In the boilers, scale coats the tubes and walls, preventing the ready absorption of heat.

All this trouble can be eliminated and is being eliminated continually by Graver Water Softeners. There are many installations within easy reach for inspection — anywhere in the oil country. In planning a new plant or in any of your operating plants let us get a sample of water, analyze it and recommend the treatment which will give you absolute freedom from hard water taxes. It won't obligate you and will show you what water softening can save you.

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Riveted
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Standpipes
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Erected Anywhere
Pressure Tanks
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Jenkins Cracking Process
Stacks-Breechings
Steel Pipe
General Steel
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Hot Process
Cold Process
Zeolite
Household
Filters—*Pressure*
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for Swimming Pools

Graver Corporation builds all types of water treating equipment. Because of this we are able to make an unbiased survey and recommendation of the type or combination of types of treatment for each water treating problem.

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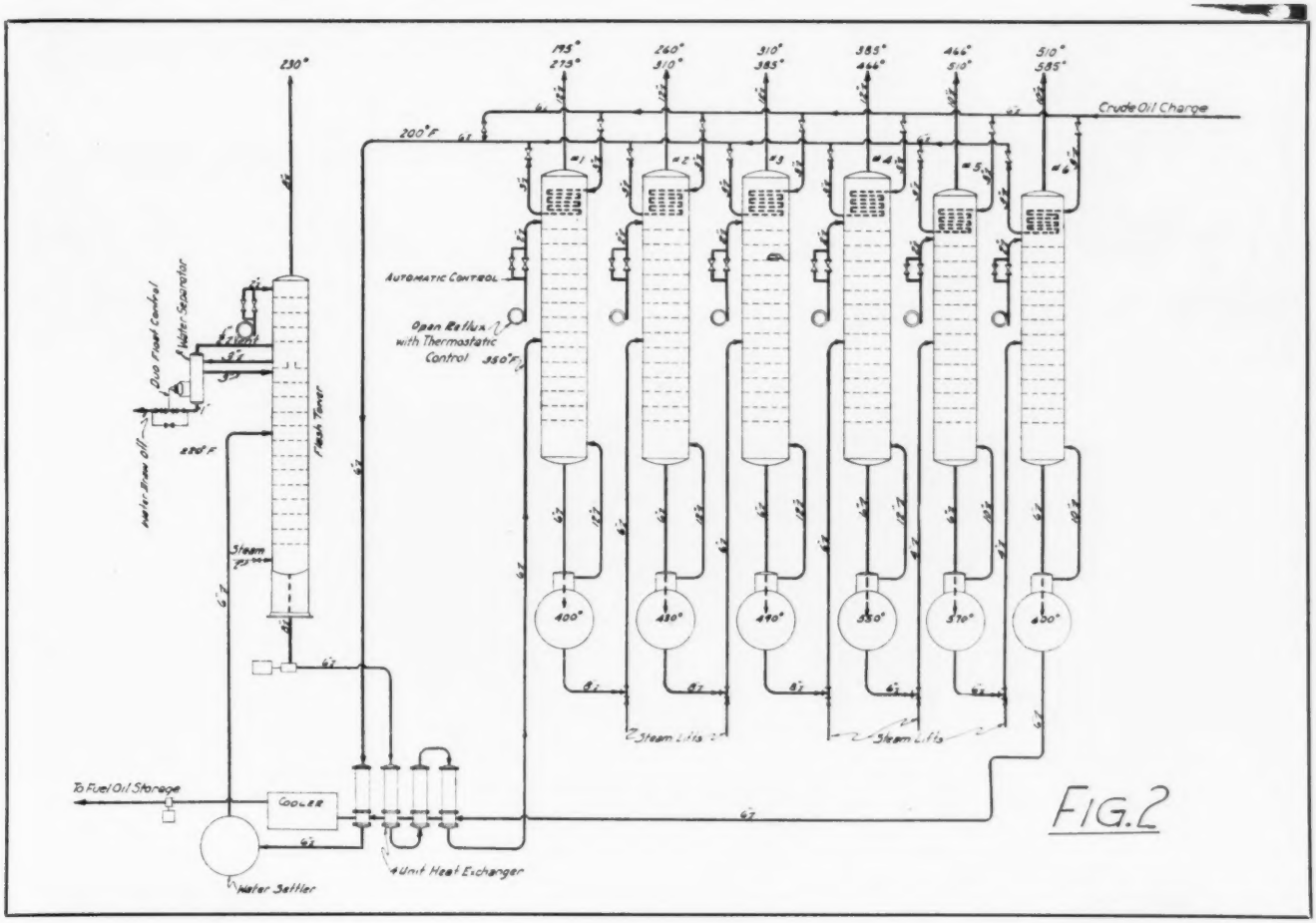


FIG. 2

changers and instruments are employed will cost more than a new tube still-bubble tower hook-up which will do the same work.

Fig. 1 is the flow sheet of a job which consisted of connecting 10 shell stills, some of them internally fired like a Scotch marine boiler, into three bubble towers. Three towers only are used because but two gasoline and one kerosene stream are desired. Before remodeling, the stills were connected almost directly to condensers, without any fractionating devices. The capacity has been increased from 7500 to 10,000 barrels per day, the stills being relatively small. Heavy finned cast iron coils are used as heat exchangers in the tops of the towers. These "knock back coils" also produce most of the required reflux.

The end points of the three streams are automatically controlled at will by "wet trim" supplied by reflux pumps. There are manholes between each pair of bubble decks. The actual piping permits the bypassing of any still. The vapor lines from the towers are manifolded into the old condensers.

Steam lifts and hot oil transfer pumps were both installed.

A side stream of gas oil off the last tower is provided for, but is not connected up. Such a stream would contain some material boiling within the kerosene range.

Fig. 2 illustrates a more elaborate shell still hook-up to new bubble towers. There were some old packed towers on this battery; but the tower shells were too small and too light, so they were discarded and complete new bubble towers were purchased.

Toncan iron pipe coils were used in the tops of the towers.

An unusual feature is the removal of all material boiling below 195 degrees F. in a flash tower in order to produce a maximum yield of a light naphtha with an initial of 195 degrees F. and an end point of 275 degrees F. The light ends thus removed boil below the boiling point of water, and hence water must be removed from the upper part of the flash tower.

While most of the refluxes are supplied by the knock back coil heat ex-

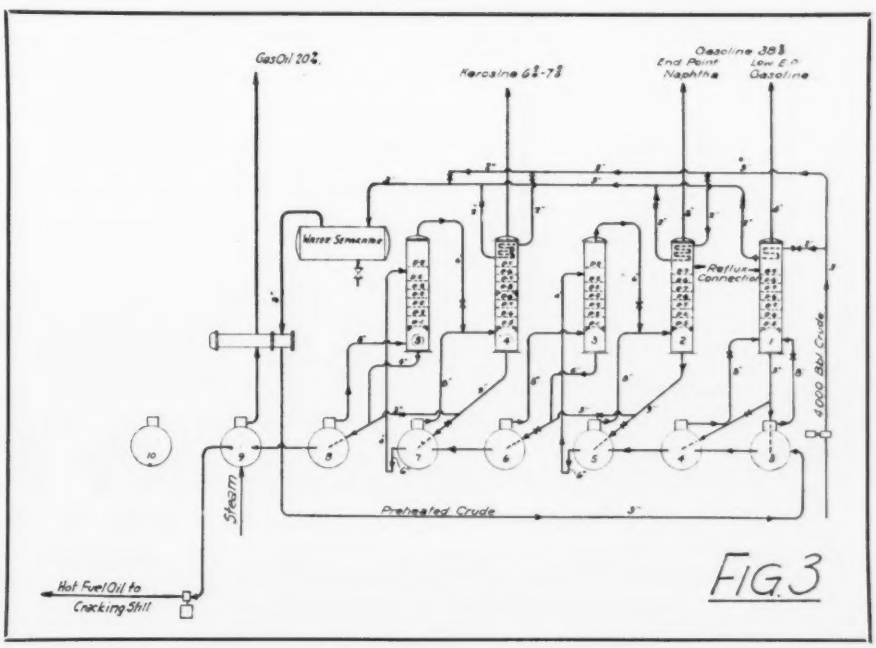
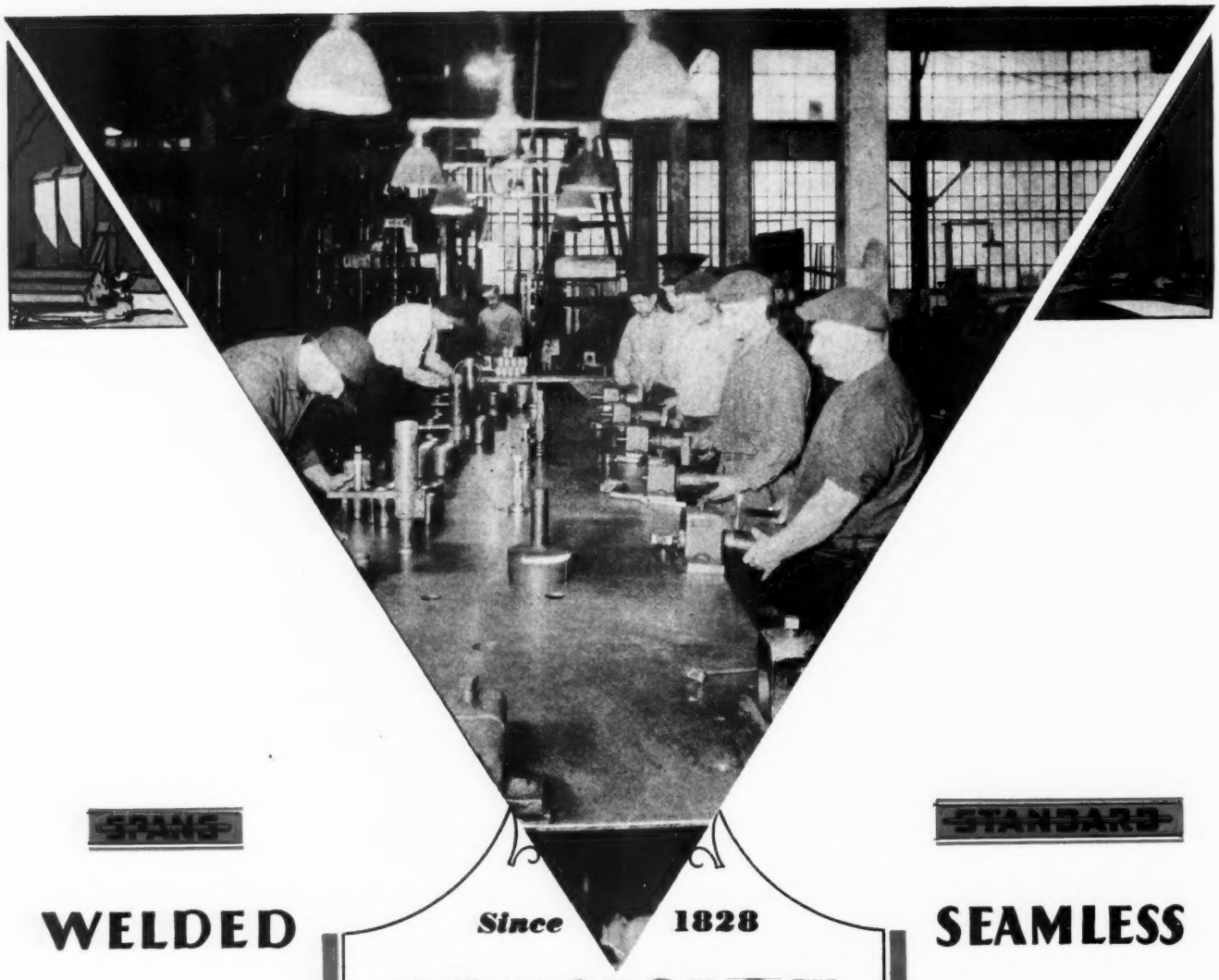


FIG. 3



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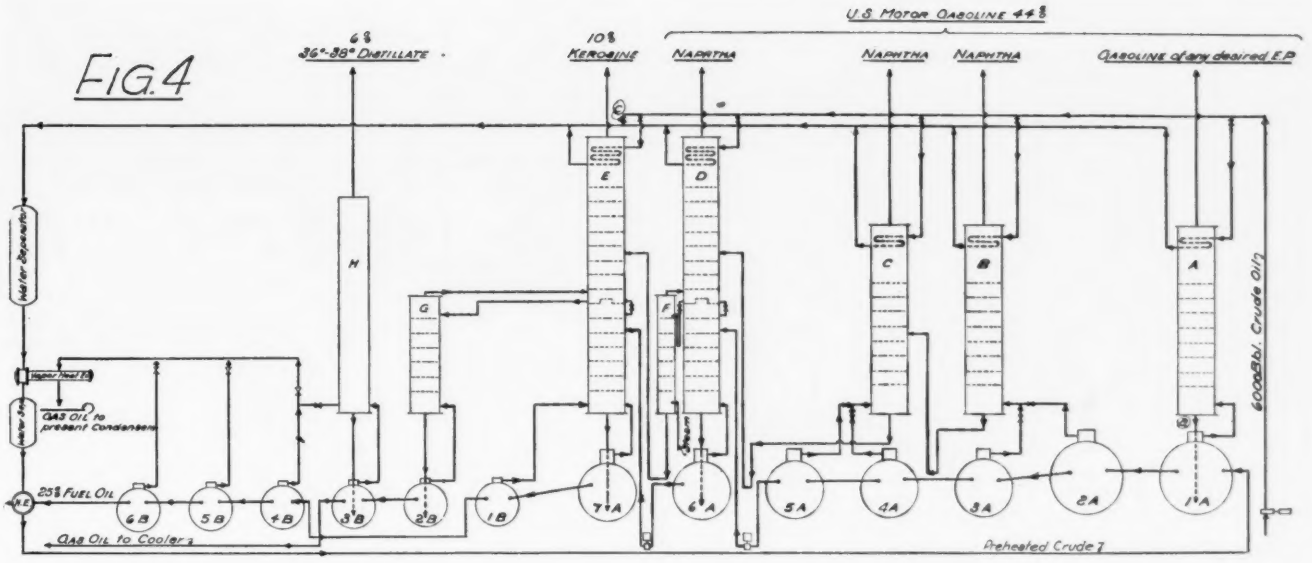


changers, the end-points of the seven streams are controlled at will by small reflux pumps with thermostatic controls.

The piping and connections are, of course, such that any still can be bypassed. In case the large number of close cut naphthas are not desired all the time, several of the streams can be combined. Each of the steam lifts can also be bypassed, in which event the oil flows from still to still through the original transfer line.

Fig. 3 is the flow sheet of a much smaller crude oil battery. The stills are 9 feet x 24 feet. They were previously individually connected to 4 feet x 16 feet and 5 feet x 25 feet baffle and packed towers some of which were in series, and operated as a continuous battery. It was necessary to rerun some of the streams for gasoline and some for kerosene in a separate rerun battery of two stills; and then good yields were not obtained.

The remodeling consisted in removing most of the old tower shells, putting bubble decks in the others, and changing the hook-up. The flow-sheet appears to be much more complicated than the hook-up. This is chiefly because the tower shells were too light, and the supports too inadequate to permit setting No. 2 shell on top of No. 3; and No. 4 shell on top of No. 5.

No automatic reflux control, or any other automatic controls are employed. The knock-back coils furnish all the reflux. Capacity was increased from 3,000 to 4,000 barrels of crude per day. The two rerun stills and the last still in this battery were eliminated. Fuel consumption for running 4,000 barrels is less than it was for 3,000 barrels and the gasoline yield is between 4 and 5 per cent better than was obtained with the old equipment.

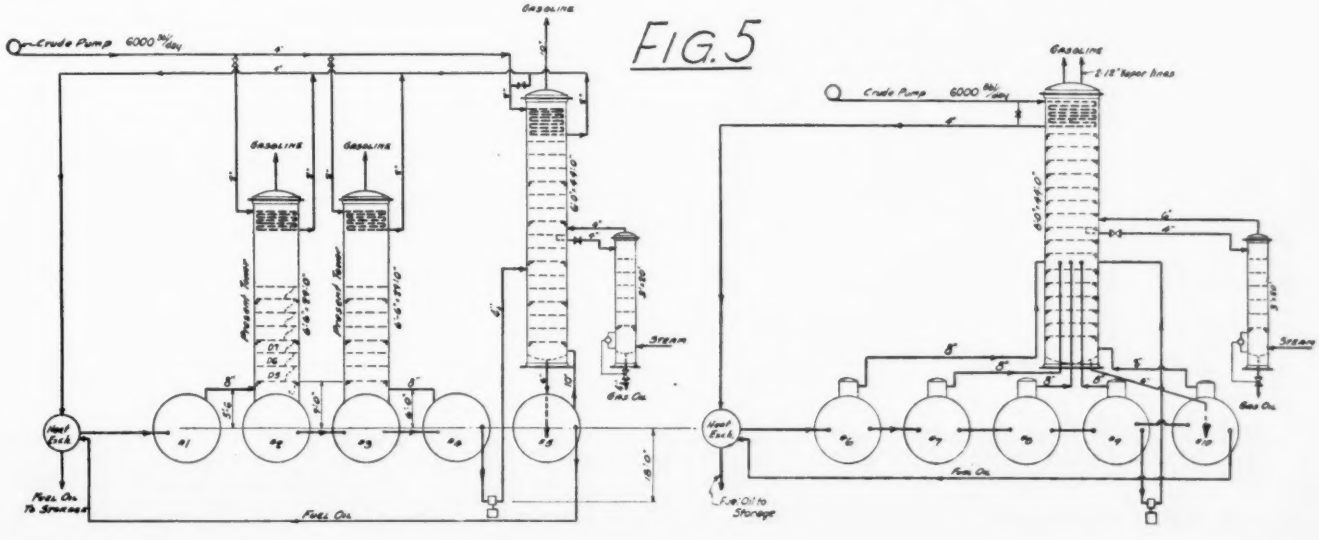
Kerosene is 27 color, and can be continuously "gapped" (A.S.T.M. gasoline distillation method) from the gasoline, if and when market conditions make this desirable. This battery positively and continuously gaps kerosene from gas oil. 375 degrees F. end-point export gasoline is cut with the first tower whenever desired.

American Radiator Co.'s cast iron clover leaf coils were put in the tops of the towers.

An important development is indicated in this flow sheet. The hot fuel oil or topped crude is run direct to cracking equipment, while the same cracking equipment now preheats the crude oil, by heat exchange, to 410 degrees F. This is not shown on the flow sheet nor is this preheat taken into consideration in the capacity and fuel consumption stated above.

Fig. 4. This hook-up differs in principle from the others in that the bottom reflux from the towers (excepting A) is not returned to the still, but is transferred from one tower to the next, where it supplies part of the required reflux, and is finally removed from the bubble tower system, and stripped of kerosene in bubble tower G, with still 2-B acting as a reboiler. A clean and complete separation is made between the naphtha and kerosene by means of the stripping column F on the reflux, and by transferring the bottoms from still 6-A into tower E.

The A battery of this hook-up was previously equipped with seven 5-x 30-foot, two 5 x 25-foot and one 4 x 30-foot uninsulated packed and baffle towers, part of them in series.



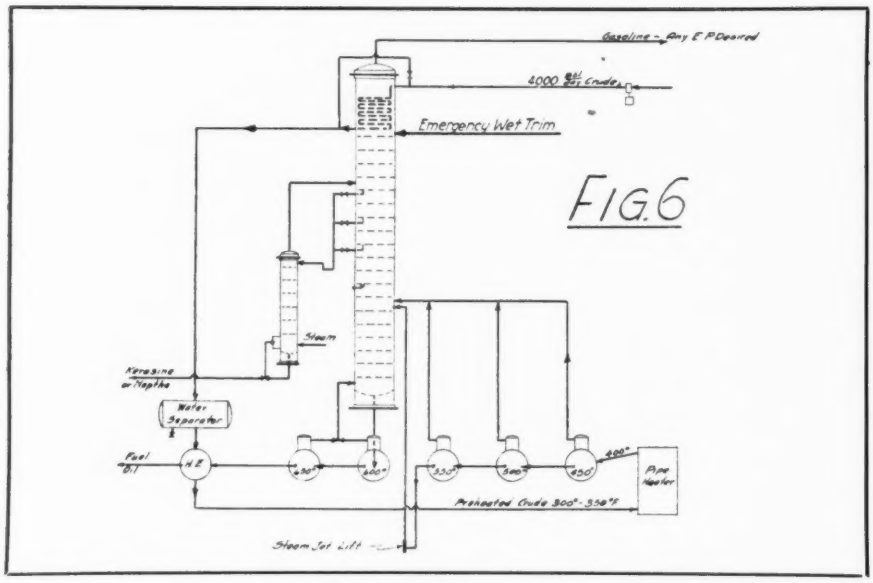


FIG. 6

The B battery was equipped with about 3-foot 6-inch x 25-foot uninsulated baffled towers, one for each still.

In remodeling, many of the tower shells were removed and bubble decks were put in others. Towers D and E. were lengthened out by cutting off the tops, hoisting parts of the discarded shells on top of them, and riveting the two together. Tower H was left as it was except for connections, and insulated to give the distillate a good color.

These alterations and additions increased the crude oil capacity of this refinery, eliminated all rerunning, lowered fuel consumption, materially improved the colors of the gasolines and kerosene, and increased the gasoline yield by about 6 per cent.

Fig. 5. This is a hook-up adapted to crudes like those of West Texas. The original equipment consisted of ten shell stills and the two bottoms heat exchangers. Stills Nos. 2 and 3 were like an inverted T, with 6-foot 6-inch x 29-foot tower shells built integral with the shells of the stills, and equipped with baffles. Bubble decks were put in these shells and two bubble towers and two stripping bubble towers were added.

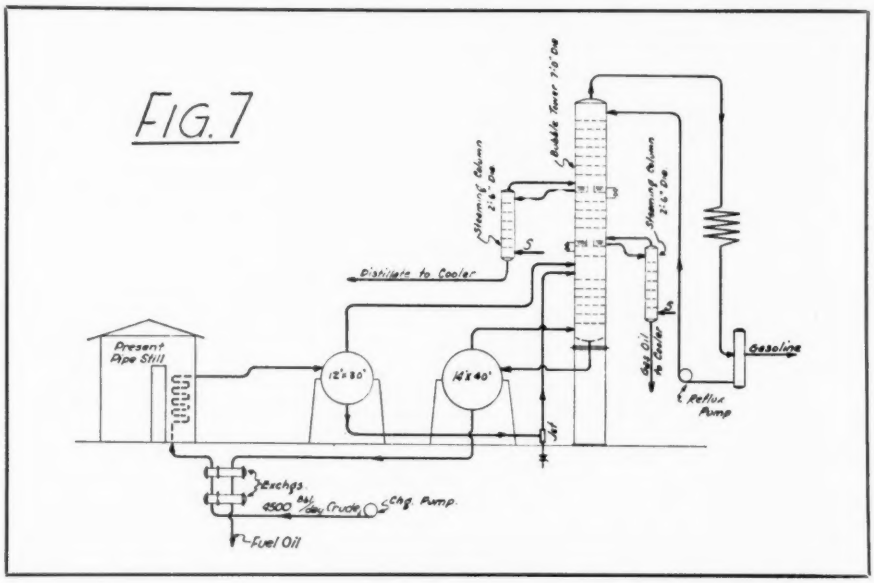


FIG. 7

The end-point of the gasoline produced can be controlled at will, and the color of this gasoline is 25 plus.

The gas oil is gapped from the gasoline, and the A. S. T. M. Open Cup flash of the fuel oil is 330 degrees F. or above.

Clover leaf coils were put in the 6-foot and 6-foot 6-inch towers, while a heavy finned cast iron coil was put in the top of the 8-foot tower.

The plant is running on West Texas crude, and there has been no noticeable corrosion of the cast iron bubble decks and caps and of the cast iron coils. However, in error, some steel pipe was used inside the 8-foot tower in connecting up that coil.

This steel pipe soon corroded out and was replaced with the cast iron pipe, which has given no trouble.

The sections of the finned coil are joined together with cast iron return bends in which aluminum ring gaskets were used. After a few months operation, a number of these aluminum gaskets were eaten through, *from the inside.* They were all replaced with lead gaskets which have apparently resisted all corrosion.

Fig. 6. This hook-up is similar to that of the right-hand battery of Fig. 5. The stills were very small and very old. The bubble tower sits on a skirt support sufficiently high so that a bottoms stripping bubble tower can be added at any time, and the shell stills and pipe heater replaced with a good tube still. If this is done an additional side stream can be taken off the tower, if desired.

Whenever desired, the kerosene can be gapped from the gasoline. There is no difficulty in controlling the distillations range of the kerosene. Its color is good, being 25 Saybolt.

Fig. 7. This is a bubble tower hook-up to two existing shell stills and an existing pipe still. It is now running West Texas crude, but would successfully handle any crude.

Fig. 8 shows another, and simpler, shell still—pipe still—bubble tower

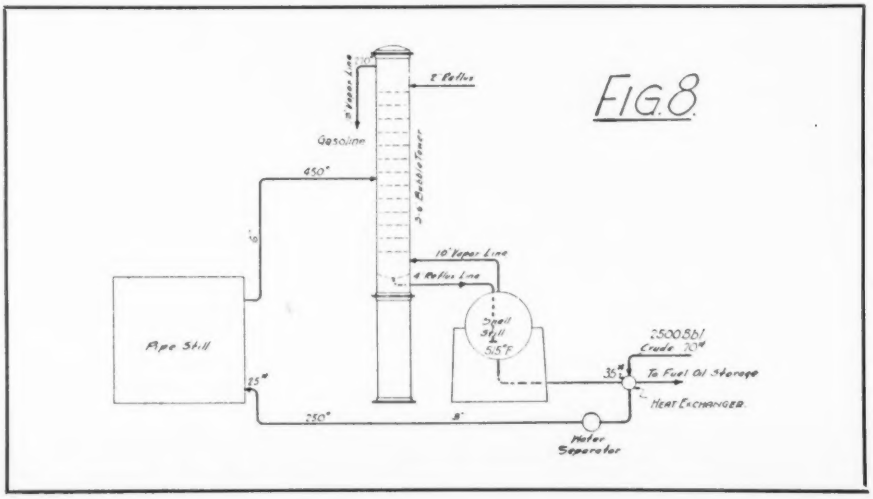


FIG. 8

3 Return Bends

with a reputation for efficiency and durability

You will find these three popular Ohiolock Return Bends helping many of the leading refineries reduce costs and get from their units the maximum efficiency demanded by today's conditions.

Simplicity of design and rugged construction are characteristic of all three—all include those time and labor-saving advantages found only in the Ohiolock closure.

Designed and made special for the conditions of each particular installation—every requirement, every operating condition, every individual desire is satisfied by these fittings of modern efficiency.

Learn how they can help you. Write today for the new bulletin.

Increased production naturally comes with the installation of Type "A" Ohiolock Frictionless Return Bends. The unique "Frictionless" oil passage through the fitting reduces turbulence and pressure drop to a minimum. The resulting 20% increase in throughput means more profit to you from each Frictionless Counterpoise unit.

The Type "B" is another return bend of the smooth flow design. While the "Frictionless" feature is not provided to the high degree found in Type "A" it has another desirable feature.

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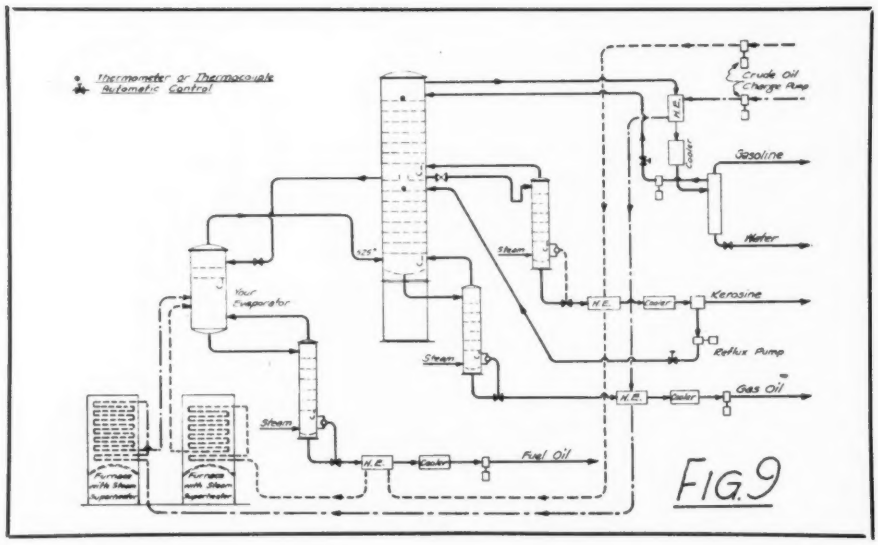


hook-up, designed for one overhead stream. Needless to say, the bubble tower was added to existing equipment.

Fig. 9 is the flow sheet of a remodeled pipe still hook up. Before remodeling, the equipment consisted of two separate pipe still units. One unit consisted of a pipe still, evaporator, and series of packed towers, together with, of course, pumps, condensers and coolers.

The other unit was a similar pipe connected to an evaporator and a bubble tower of poor design. One 6-foot 6-inch bubble tower, with three stripping towers, as illustrated, was installed, and existing pumps, heat exchangers, condensers and coolers, and one of the evaporators were utilized.

The capacity was materially increased, operations were simplified, and good separations were obtained, which were impossible with the original equipment. Two bubble decks were put in the old evaporator, and a small amount of reflux provided for them, in order to insure a gas oil of a good color.

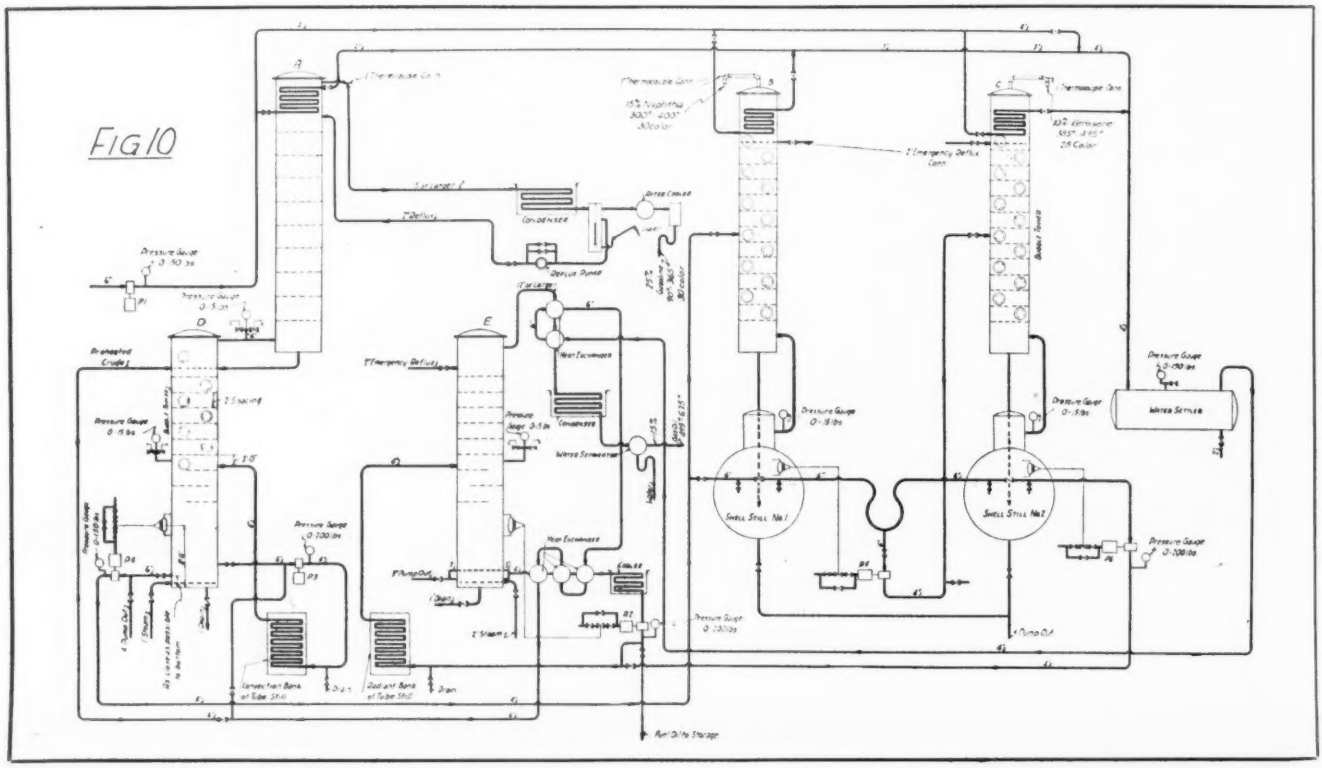
Fig. 10. This is the Goldberg of the lot. The existing equipment consisted of bubble towers A, B and C; evaporators D and E; shell stills Nos. 1 and 2; a tube still containing two separate banks of tubes; condensers on stills Nos. 1 and 2; an inadequate condenser attached to evaporator E; a coil in the top of bubble tower A, and coils in the tops of evaporators D and E; some instruments and gauges; piping and some pumps; two bottoms coolers; and two tail houses.

Previous operations had not been profitable. The two shell stills were operated batch. The two heating coils in the tube still were operated separately. The maximum thruput was somewhere around 2,000 barrels per day of Mid-Continent crude.

Additions and alterations are largely shown in the flow sheet. The two shell stills were hooked up for continuous operation in series. The stack was moved from the back to around in front, breechings were put on front and rear, and 4-inch fire tubes were put in the shell stills. Coils were put in the tops of towers B and C, and manholes were welded in between each bubble deck, which were 2 feet apart.

The old bubble decks in tower D were changed from 18-inch to 24-inch spacing, and manholes placed between each two decks. The bubble decks in tower E were cleaned and replaced. The top of E was left uninsulated, and this, together with the old decks removes entrainment and gives a gas oil of a good color.

A condenser, cooler, and refluxing equipment was attached to tower A. Heat exchangers were put on the gas oil vapor line and on the fuel oil line. A few additional pumps were purchased and installed. All the streams were brought through one tail house. This new hook-up is running 5,500 barrels per day of crude oil, taking a total of 65 per cent overhead.



Much Brainwork and Little Expenditure Wipes Red Ink Off Refinery Books

By D. F. Gerstenberger*

OIL refining is approaching more every year the fundamental basis which has been so essential in stabilizing our other large industries. The secret methods of privately controlled operations, and the atmosphere of mystery which at one time surrounded the operations and methods of each individual concern and branch of the industry, have almost entirely given way to the more constructive and beneficial methods of cooperation.

This makes it possible for the smaller refiner to profit by the experience of the larger groups where he will, and to establish his business on the same sound principles of operation that have enabled the bigger companies to continue to operate profitably.

The industry as a whole is undergoing, and will continue to undergo many and varied changes. The refiner who sits down satisfied with his present operation and the results obtained, will find himself in a somewhat precarious position in a comparatively short time.

In view of the fact, however, that he has available for his own use standardized equipment and methods of operation which are general throughout the industry, which have been made available to him largely by the growing spirit of cooperation, the success of his enterprise rests largely on his willingness to *wisely* make use of the proper improved methods and equipment for his particular problems.

This paper will endeavor to show how this very principle has been followed out in helping to make the plant of the American Refining Properties at Wichita Falls, Tex., one which would pay dividends, instead of operating at a bare profit, and during many seasons of the year at a loss. It deals with the solutions of both operating and mechanical problems and covers in a general way practically every phase of its particular operation.

Skimming and Cracking Equipment

The plant as a whole had been at a standstill for several years. A battery of five crude stills were available. One still had a bubble tower, the other four being equipped with one baffle tower to each still. Five rerun stills were also at hand which likewise had only one bubble tower, the other four being the same as those on the crude stills.

The plant also included two Cross

D. F. Gerstenberger

units and four Dubbs stills, a continuous treating plant and three batch agitators with all necessary pumping units, tankage, etc. The Cross units were the old cold feed, one-pass type.

The Dubbs units consisted of four 50-tube furnaces with satisfactory 10 by 30 foot chambers and dephlegmators for two of the units.

The extra two furnaces were being used as pre-heaters for the two which were tied into the 10 by 30-foot chambers. Aside from this equipment was a 5000-barrel Foster pipe still which was used mainly for skimming gas oil from fuel for Cross charging stock.

A careful check of the stream distillations from the crude stills showed that the kerosene contained some 15 to 20 per cent of gasoline when the stills were run for U. S. Motor. The Cross stills were operating on about a break-even basis on a 7-cent gasoline market. The pipe still operation was an expense to the refinery operation as a whole.

The Dubbs were the only stills which showed any appreciable profit. The rerun stills, which were used for the final fractionating and finishing into gasoline of the combined treated pressure distillates, were producing 7 per cent less gasoline than was possible to meet U. S. Motor tests. This was traceable to treating methods, it being impossible to produce a gasoline of marketable color from this operation above 410 F. end point.

Vapors from the tanks and stills were all passing to the air, instead of being handled as is customary by proper absorbing methods.

Big Losses Attacked First

After a careful survey and compilation of yield and cost figures, the biggest losses were first attacked. Experiments were carried out to ascertain the best method for treating the pressure distillates from the particular cracking stock being run, and by the process of elimination a treating and rerunning method was devised which gave a good, stable cracked gasoline of better color at 437 end point than had previously been obtained at 410.

This method consists in the main of a preliminary sludge acid treatment followed by a light treat with 66-degree acid, after which lime water is used for a neutralizing wash with a final caustic wash. The distillate so treated is then rerun with fire and steam for finished gasoline which is given a final sweetening with doctor solution.

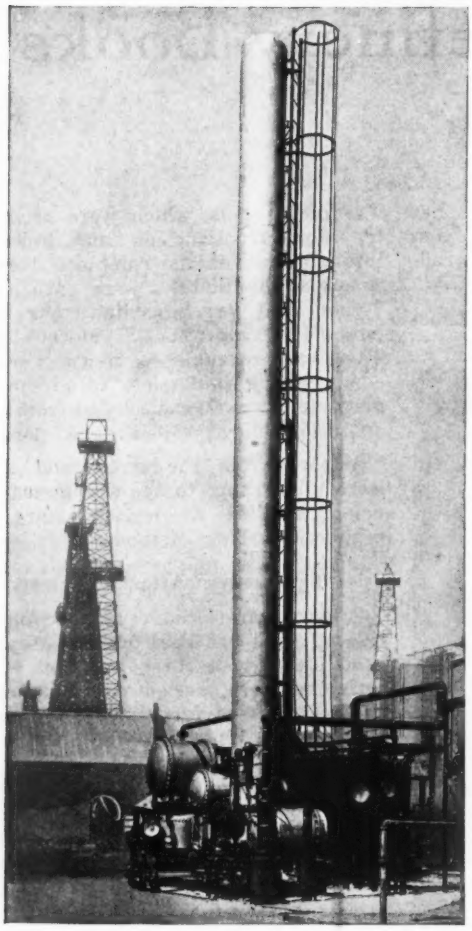
During the rerunning operation a soap solution is fed into the bubble towers which brings about the desired fractionation and at the same time treats the vapors so as to neutralize the detrimental effects of sulfonation brought about by the heat applied for distillation.

The next improvements undertaken were the erection of a suitable absorption plant and the converting of the Cross units from the cold feed type over to the more modern and more efficient hot feed system.

The absorption plant was constructed partially out of material available on the ground, and partly by the purchase of new equipment for the essential points. Braun exchangers and condensers, and an Ingersoll-Rand low pressure compressor were used. Cooling coils, pumps, scrubbing towers, bubble absorber, and distilling equipment were either available or were

*Superintendent, American Refining Properties, Wichita Falls, Tex.

From a $$$ and ¢¢¢ Standpoint . . .



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	Raw Feed % Liq. Vol.	Finished Product % Liq. Vol.	Residue Vapor % Gaseous Vol.
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Ethane	0.583	0.000	11.420
Propane	12.220	0.000	88.580
Iso-Gutane	5.920	3.305	Trace
Normal-Butane	23.200	30.000	0.000
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fabricated from equipment on the ground. This plant produces 60 barrels a day of gasoline during the colder months, and 125 barrels a day during the summer months in addition to about 300,000 cubic feet of gas a day which is used as plant fuel.

Prior to its installation all of this gasoline, and a large part of the gas was simply evaporating into the atmosphere. The actual cost of operating this unit is about one-tenth of the value of the products produced.

Modernizing Cracking Units

By using some discarded reaction chambers as hot feed tanks and purchasing two hot oil pumps and the necessary valves, tubing, and fittings, an efficient hot feed system was installed on the Cross plants which gave an increased yield of gasoline and cut the cleaning costs, thereby bringing these stills into line as one of the paying operations.

These stills are now operated on a 15-day cycle with about 12 hours down time for cleaning, and are giving a yield of about 58 per cent of gasoline from 30-32 gravity gas oil.

Six bubble towers were erected on the crude and rerun stills making possible the production of a more uniform grade and better quality of products, and at the same time insuring a maximum yield of each grade. Special naphthas, where advisable, can now be made which previously was next to impossible, with the exception of one grade.

As a result of these improvements, the net yield of gasoline has been increased about 7 per cent, based on the crude, and practically all gasoline shipped from the plant is 30+color, doctor sweet and passing all corrosion tests.

It is next to impossible to cover in a paper of this length the minor items which have been corrected to bring about either increased yields, or saving in operating costs. One item which will probably be of interest is the use of water for fractionation in the bubble towers.

This is fed in on the upper decks by sensitive control with one-quarter inch valves, the evaporation of the water bringing about the condensing of the heavier ends of the vapors, so that each tower makes its own reflux, instead of using the conventional wet flux. One small centrifugal pump does the work for a battery of 10 stills.

A low pressure, pressure gauge on the ½-inch water line going to each tower, records the friction pressure in these individual lines, which pressure increases as the amount of water used increases, and decreases when less water is used, and consequently acts as an index for control.

The condensed water coming from the streams in the receiving house is drawn from a water leg on each run-in line, and returned by gravity to a

Low pressure gauge used on water lines to each tower. The pressure on the gauge indicates the relative amount of water being used. The small by-pass on the right is the control valve

10-barrel tank from which the centrifugal pump takes its suction. In this way the water is used over and over again, and the possibility of scale forming materials collecting on the bubble caps and trays which would exist were the average raw water used, is eliminated.

The condensed water obtained from the use of steam in the distillation adds to the amount used for fractionating so that a little excess is overflowing from the tank at all times. This excess may be returned to the boilers for feed water, for in this instance it runs only about 7 grains of hardness.

This system has eliminated the use of six reflux pumps which has considerably reduced the steam consumption.

Together with the improvements in equipment and the quality of products, an accounting system has been installed for keeping a proper check on each unit operation. Individual daily operating reports are made up which make it possible to immediately overcome adverse operating conditions.

More Cracking Improvements

A program is now under consideration for the improvement of the Dubbs stills which will involve a new furnace, improved hot oil pumps and flashing system, and thereby make these stills absolutely modern in every respect, and put them in the position of producing the maximum amount of gasoline possible at the lowest possible cost.

So much for improvements in distillation. The use of chemicals is always an expense to every refinery operation. This plant was no exception to the rule. The amount of litharge used was one of the expensive items and for the kind of crude being run, the quantity used proved to be excessive.

In addition to treating the finished gasolines and kerosene with doctor, the pressure distillate was also sweetened before being rerun for finished gasoline. The effects of this sweetening were lost in the rerun operation and a final sweetening was still necessary. Consequently the use of litharge prior to rerunning was discontinued, and a 16 degree Be. caustic wash was substituted.

This cut the amount of litharge used more than in half. This was later reduced to a negligible amount by the installation of the first commercial litharge recovery system of the Feilschmidt-Cantrell process. This process recovers the litharge back to lead oxide state, returning the sulfur and caustic in proper shape for reuse at an extremely reasonable cost. Incidentally, the lead oxide recovered is a much better treating agent for cracked gasoline than is new lead.

Boiler Feed Water Treated

Lime and soda ash are used as a treatment for boiler water. The sludge obtained from this treatment had resisted all efforts for any use except as white-wash and even there the adhesive properties were lacking. The matter of disposal became a serious problem. One large pit was already filled.

At the same time the usual rapid deterioration was being experienced in the water wash tower of the continuous treating system, where the pressure distillate was being washed with water after acid treatment. It was found that by mixing this lime sludge in a thick solution with water, holding it in suspension by rapid circulation with a small centrifugal pump, and feeding it in small quantity through a ½-inch line into the water just as it entered the wash tower that the effects of the acid water were entirely neutralized.

The quantity used is governed by testing the water being drawn continuously from the bottom of the wash tower. In addition to saving the equipment, this method takes care of the disposal of the lime sludge which passes off in soluble form in the waste water.

The quality of the finished gasoline obtained from rerunning the distillate so treated is also greatly improved and although we still use a final caustic wash after the lime treatment as a safeguard, the quantity of caustic used is less than one-fourth of that previously used.

Although still in the maze of continued improvements both mechanical and operating, the most essential ones have been fairly well covered, at least to the point of enabling this plant to put out an excellent grade of products at a profit.

How Still Capacity Can be Increased By Simple Furnace Changes

By James S. Alcorn*

IN THE past few years considerable attention has been given and large sums of money have been spent by the management of refineries, in an effort to increase throughput, raise the standard of their products and improve the efficiency of their operation, without purchasing new equipment.

In all refinery operations probably fuel and fuel burning equipment are the most important factors entering into the question of the safe capacity of the plant, the cost of its operation and the quality of its product. Most of the refinery furnace equipment that has been developed and installed within the past two or three years, has been designed with the assistance of competent combustion engineers.

This has resulted in a very marked improvement in furnace construction and by contrast has shown the need of improvement in the older units.

Many refinery executives, however, are confronted with the economic problem of justifying the entire rebuilding of costly equipment that is in good working condition, or scrapping it and replacing it with new construction just to secure a small increase in throughput or raise the fuel efficiency. This justification cannot always be proven to the satisfaction of the board of directors, and often when it is, the capital structure of the company will not permit of its being done.

It is for the benefit of refineries having either of these conditions that this article is written, describing a very inexpensive method of improving furnace conditions and one that is being adopted by many plants, large and small.

Because of the necessity for improvements in refinery operation above mentioned, largely due to low prices and strong competition, considerable research and experimental work has been done on the subject of heat generation and its application to heat absorbing structures in the oil refining industry.

These investigations have clearly demonstrated that a large portion of the heat that is transferred to the oil in any still is applied in the form of radiant heat, and that where any heat absorbing structure is subjected to both radiant heat and the direct heat of the gases, it is absolutely necessary that combustion be completed before the gases impinge on the heating surface or furnace walls.

In furnaces now being constructed this fact is being taken into consideration in the design of the furnace proper by separately applying the radiant heat and the convection heat. In a shell still, or a tube still where the heating element consists of a bank of tubes, the amount of fuel that can be fired is limited by the combustion area, and the efficiency of the furnace from a fuel standpoint is to a great extent determined by the maximum allowable temperature in the furnace chamber.

This temperature is usually kept below the danger point by the use of excess air. These types of stills are generally fired as hard as possible, and an attempt to increase the amount of fuel or to reduce the percentage of excess air usually brings so much grief in the shape of hot spots (caus-

*President, Alcorn Combustion Co., Philadelphia.

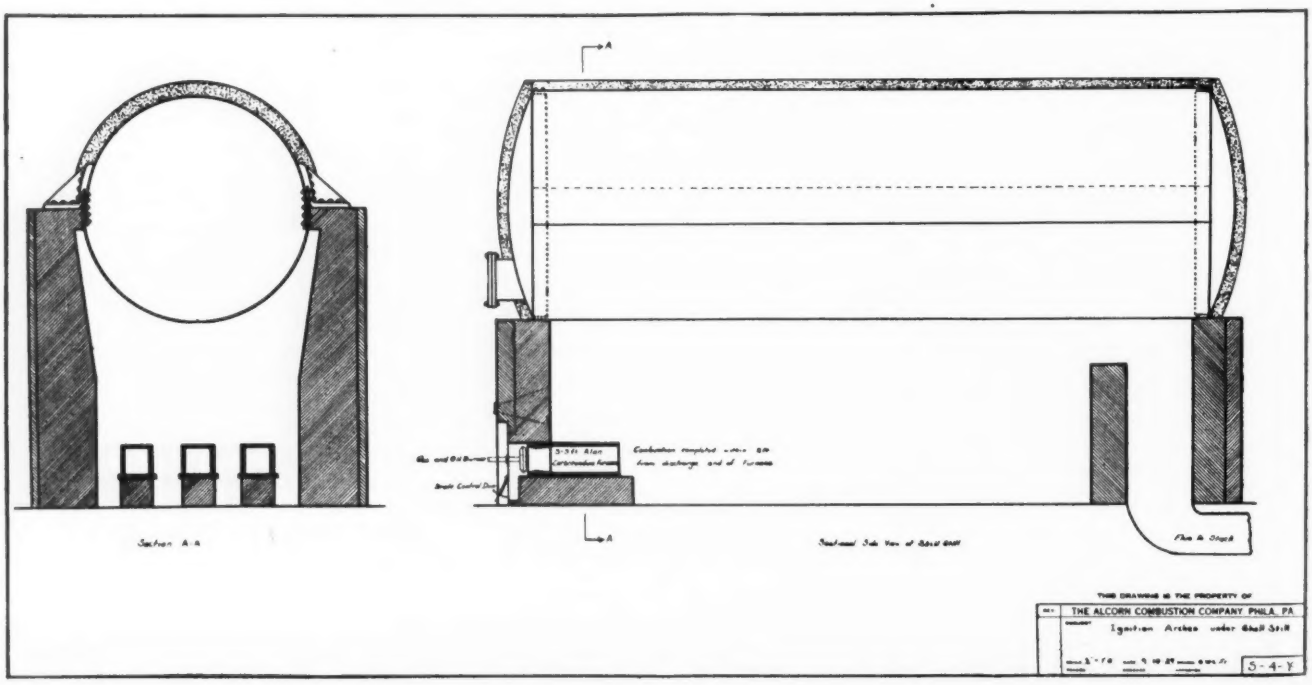

Plate I—Ignition arches under a shell still

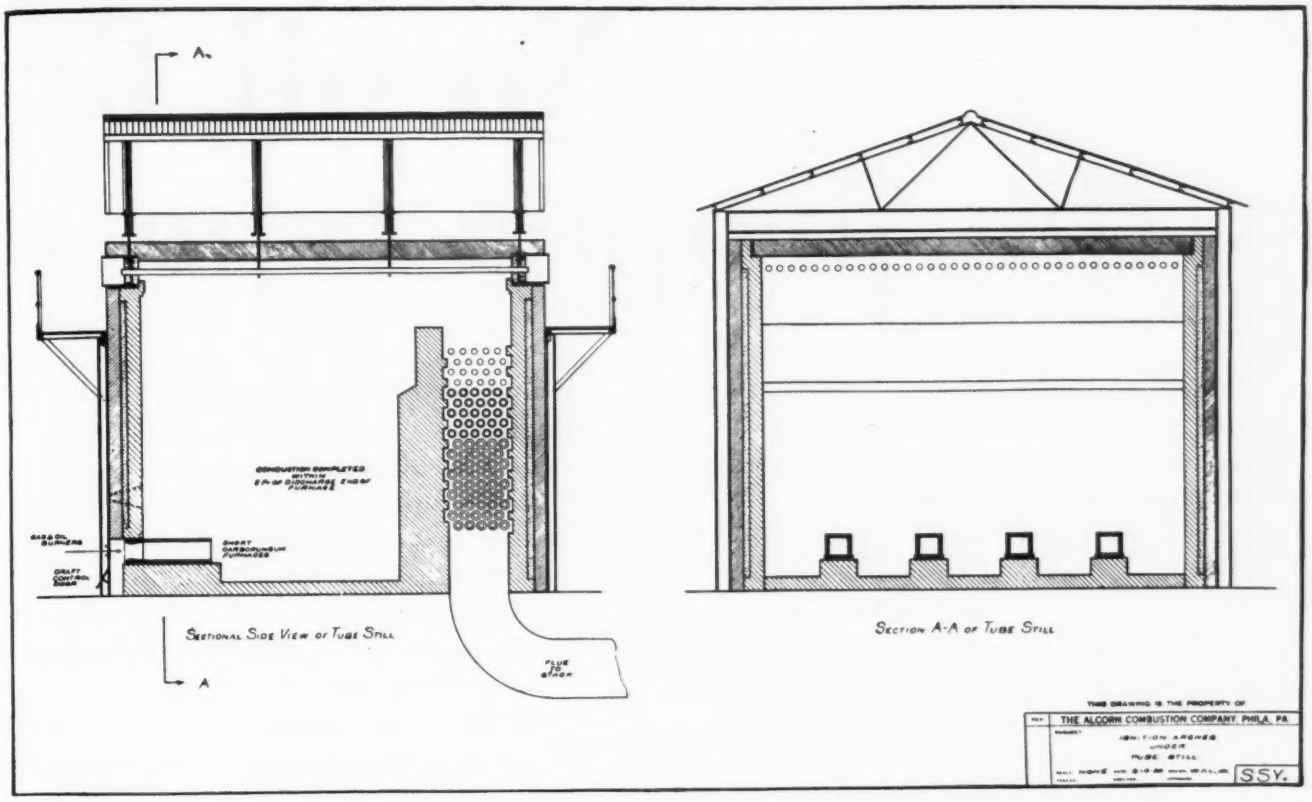

Plate II—*Ignition arches under a tube still*

ing expensive shut downs) and wall and shell or tube maintenance, that it is quickly abandoned.

It is generally known that in nearly any of these units one can raise the CO_2 in the gas to 11 or 12 per cent by simply closing down on the damper, but the result is that the furnace temperature rises, generating more radiant heat and causing shell or tube trouble. To secure efficient furnace operation in what is known as an open-fired unit, it is essential to design the size of the combustion chamber for the amount of fuel to be burned.

If the chamber is too small the temperature of the furnace becomes too high and overheats the bottoms. If it is too large, there is neither good mixing of the fuel with the air for combustion nor is the furnace temperature sufficient to properly support combustion.

In either case excess air (in many cases as much as from 300 to 4000 per cent) has to be used. Where the furnace volume is too small, excess air is used to reduce the temperature of the setting, and where it is too large excess air is necessary to secure complete combustion of the fuel.

In all furnaces of the above mentioned type additional fuel can be burned, resulting in increased capacity, if the combustion is positively completed before the gases strike either the shell bottom, the tubes, or the walls of the furnace; and better fuel economy can be secured if the fuel and the air for combustion are properly mixed. It was for that purpose that the method of firing shell stills and tube stills shown in Plate No. 1 was developed.

The installation is inexpensive and consists of a number of short firing chambers of small cross section resting on the floor of the furnace chamber. Within a few minutes after starting firing, these chambers become incandescent and due to their small cross section, act as mixing chambers of the most efficient type, mixing the fuel with the air for combustion in contact with walls at temperatures of at least 2000 F.

This insures a rapid completion of combustion with very little excess air, and avoids the danger of having combustion completed on the walls of the furnace or the heat absorbing structure.

It is necessary to build these firing chambers of an extremely high temperature refractory, and it is preferable that the material also have as high a heat conductivity as can be secured, because the front part of the still that is directly over the firing chamber will then receive heat by radiation directly from the chambers and do its share of the work.

In most furnaces the part of the shell directly over the burners does little or no work, which puts a greater burden on the balance of the heating surface and is a factor in limiting the throughput of the still. We have found that silicon carbide, sold under the trade name of carborundum, gives very satisfactory results.

The number of chambers to be used in any furnace is determined by the amount of fuel to be fired. Each chamber has a capacity of from 25 to 35 gallons of oil, or its equivalent in gas, per hour. This limit is due to the fact that to secure the best furnace conditions the air for combustion must be induced at the burner.

If it is necessary to depend on stack draft for the air for combustion, poor efficiencies are secured or bottom or tube trouble is encountered. A high stack draft tends to stratify the gases and results in a low transfer because of the lack of contact with the heat absorbing surfaces or the walls of the furnace proper. If the gases are forced against the heating surface at high velocity, localized overheating will result.

In either event the stack loss becomes greater. Where the air is induced by the burner a balanced condition can be secured with the use of a stack damper. By this means an even application of the heat to the entire heat absorbing structure can be secured, and the stack loss reduced to the minimum.

It will be apparent that by the use of a multiple of independently op-

(*Continued on Page* 107)

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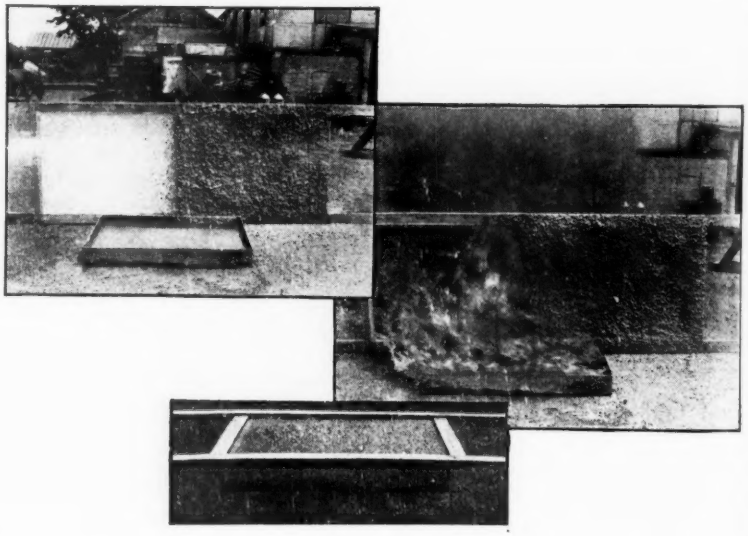
The photograph at the left shows a double frame covered with a single strip of cheese cloth—one section covered with *Firefoam*—the other saturated with the discharge from an ordinary soda-acid extinguisher.

The pan of gasoline in front of this frame is then ignited. The picture at the right tells the story. Fire has totally destroyed the soda-acid saturated cheese cloth. The *Firefoam*-coated cloth is untouched—perfectly insulated by the fire resistive *Firefoam* blanket. The fire is then extinguished by placing the *Firefoam*-protected section of the frame over the pan and smothering the flames.



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erated combustion chambers a very elastic and efficient firing range can be secured. If the maximum firing rate requires four combustion chambers, then as the rate of firing is reduced, one or more of the chambers can be completely cut off, the stack damper closed proportionately and the furnace efficiency maintained.

This type of installation is a decided step in advance of the dutch oven, gives all the advantages of the dutch oven, but eliminates the high maintenance costs. In addition it distributes the heat very much more uniformly and gives a greater firing capacity because of more intimate mixing conditions.

Deconcentration of Feed Water Avoids Many Ills of Boiler Operation

By Elwood W. Scarritt*

ONE of the chief problems confronting refiners and many other plant operators is that of providing a proper boiler water for the safe and economic production of steam. The solution of this problem involves the conditioning of the available water supply in a manner conducive to best results and dependent upon the nature of the impurities in the natural water.

Chemical impurities commonly present in boiler water may be divided into two classes, those that remain in solution and contribute to soluble concentration, and those that become insoluble at boiler temperature and contribute to the formation of scale or sludge.

Proper conditioning of boiler water not only precludes the formation of scale, but minimizes the concentration of soluble salts and provides for the removal of the insoluble impurities as a concentrated sludge without wasteful blowdown. This is accomplished by means of a system of deconcentration perfected after more than 20 years of development and use.

One of the fundamental prerequisites of deconcentration is the control of chemical reactions within the boiler to change soluble salts to an insoluble form. The sound and economic value of the correct deconcentration of boiler water is fully realized only by proper control of these chemical reactions and the continuous removal of the chemical by-products thus produced.

Deconcentration involves the definite chemical control of reactions within the boiler to produce the maximum quantity of suspended solids or sludge, the continuous circulation of a portion of the boiler water through a settling tank where the suspended solids deposit and the return of the clarified water to the boiler. Figure 1 illustrates the deconcentrator as applied to a Stirling type boiler.

The correct chemical balance within the boiler for deconcentration is not necessarily maintained by means of chemicals or compounds added to the boiler water, but may be fully realized by the use of external water softening equipment, such as the zeolite softener, the lime-soda softener, or other external means.

The source of the means to realize the correct chemical reaction is of minor importance, provided the reactions are correct for the steaming condition under which evaporation is taking place.

Each of the various salts found in a natural water has definite and specific properties under heat and pressure within the boiler. Correct chemical control takes into consideration these known properties to produce reactions which contribute to maximum efficiency in deconcentration.

Deconcentration

The principle of deconcentration, as previously stated, includes the maintenance of a definite control of the chemical reactions within the boiler, producing the maximum quantity of insoluble matter or sludge, continu-

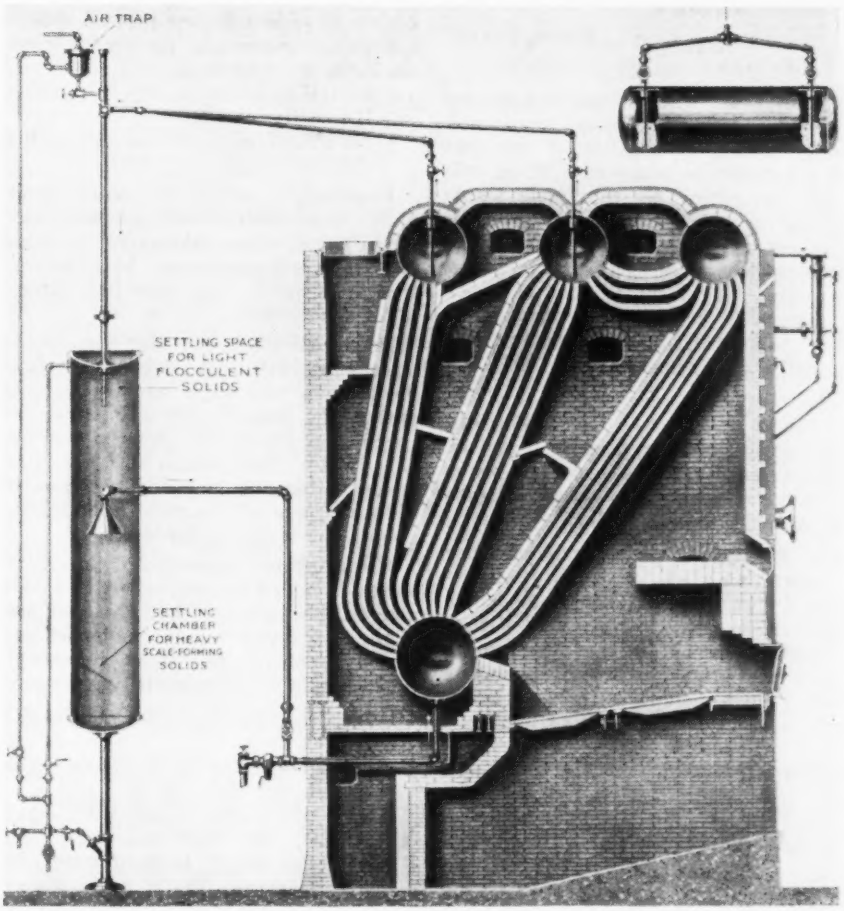

Fig. 1—Elgin deconcentrator operating on a Stirling No. 1 boiler

*Chief chemist, Elgin Softener Corp.

ous circulation of a portion of the boiler water through a settling tank where the suspended matter is removed and the return of the clarified water to the boiler.

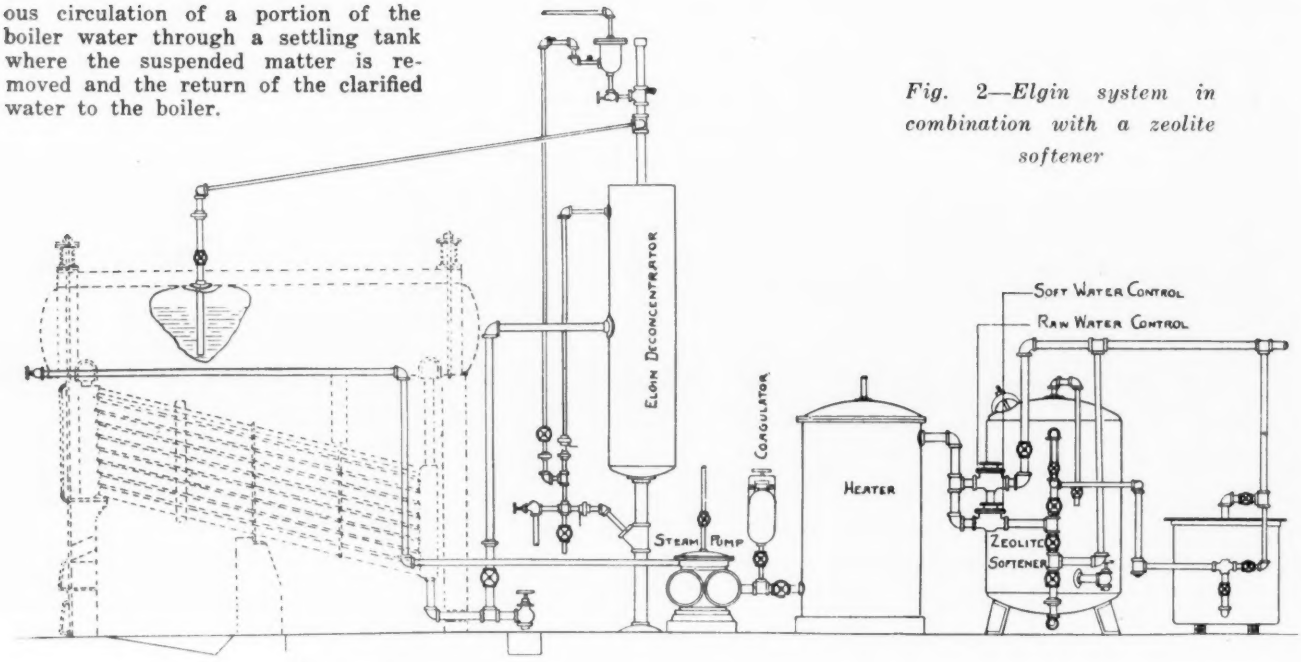

Fig. 2—Elgin system in combination with a zeolite softener

Deconcentration with certain kinds of water may be extremely simple. A water containing calcium bicarbonate as the principal impurity, under heat and pressure within the boiler, liberates carbon dioxide, producing calcium carbonate, which precipitates as a sludge and is removed by the deconcentrator, returning the clarified water to the boiler.

$$Ca(HCO_3)_2 + \text{heat} \rightarrow CaCO_3 + CO_2 + H_2O \quad (1)$$

Some feed waters carry colloidal material or finely divided suspended matter which is coagulated by heat and may then be removed. When colloidal impurities in the feed water are more stable or when precipitates are formed that are too fine to settle readily, it is necessary to add a coagulant. As soon as the particles of impurities become large enough to settle rapidly they are automatically separated and removed.

The proper chemical control within the boiler to produce a satisfactory condition for deconcentration may be realized from suitable external water softening systems or by proper chemicals applied to the boiler.

The factors of primary importance in determining the suitability of external or internal treatment for boiler water deconcentration are the nature of the impurities in the feed water supply and the operating conditions under which evaporation is taking place.

Zeolite Deconcentrator Combination

In the zeolite or base exchange method of external softening, salts of calcium and magnesium are replaced by the equivalent sodium salts. When water containing carbonate hardness is softened by the zeolite process, the calcium bicarbonate and the magnesium bicarbonate are changed to sodium bicarbonate.

$$Ca(HCO_3)_2 + 2NaZ \rightarrow 2NaHCO_3 + CaZ_2 \quad (2)$$

$$Mg(HCO_3)_2 + 2NaZ \rightarrow 2NaHCO_3 + MgZ_2 \quad (2A)$$

Sodium bicarbonate, under heat and pressure within the boiler, first breaks down to sodium carbonate, commonly known as soda ash, and then to sodium hydroxide, commonly known as caustic soda.

$$2NaHCO_3 + \text{heat} \rightarrow Na_2CO_3 + CO_2 + H_2O \quad (3)$$

$$Na_2CO_3 + H_2O + \text{heat} \rightarrow 2NaOH + CO_2 \quad (4)$$

Evaporation within the boiler gradually concentrates the caustic soda to a point where blowdown becomes excessive and continuous high concentration involves the potential danger of embrittlement.

Deconcentration provides a means to overcome both the extensive blowdown and the high caustic content within the boiler. For each grain of carbonate alkalinity present in the raw water the zeolite process produces within the boiler 1.06 grains of soda ash, one of the most widely used agents for water softening.

If the proper quantity of raw hard water is added to the boiler, the soda ash will be destroyed and the hardness in the raw water will be converted into sludge, removal of which is accomplished by the deconcentrating system.

$$Na_2CO_3 + CaSO_4 \rightarrow CaCO_3 + Na_2SO_4 \quad (5)$$

In boiler water. In hard water. To Deconcentrator.

$$2NaOH + MgSO_4 \rightarrow Mg(OH)_2 + Na_2SO_4 \quad (6)$$

In boiler water. In hard water. To Deconcentrator.

By means of an arrangement such as illustrated in Figure 2, zeolite softened water and raw hard water may be fed to the heater in any desired proportion. It is possible with certain of the high calcium bicarbonate waters to reduce blowdown 70 to 80 per cent of the amount required with zeolite softening alone, and at the same time to maintain within the boiler a low caustic alkalinity.

A survey recently completed was made on a 150 horsepower, horizontal return tubular boiler, operated at 125 pounds pressure The tests covered a period of more than 8 months. During the first 4 weeks, all of the make-up water was softened by the zeolite process. Figure 3 shows the concentration of total alkalinity and of caustic soda which accumulated in the boiler.

Starting at 16 grains per U. S. gallon, the alkalinity reached a concentration of 84 grains by the end of the second week. At this point the boiler was heavily blown down and raw hard water was added to bring the water up to the proper level. This lowered the alkalinity but during the fourth week the alkalinity reached a concentration of 121 grains.

The concentration of caustic soda, also shown in Figure 3, behaved in much the same way, reaching a maximum value at the end of the fourth week of 53 grains per gallon.

At the end of the fourth week the deconcentrator was placed in service and raw hard water was used for make-up until the alkalinity was reduced to about 20 grains per gallon.

Then for a period of 220 days a mixture of zeolite softened and raw hard water was used for make-up. By using the proper amount of zeolite softened water, just enough soda ash and caustic were produced to soften the raw hard water entering the boiler at the same time. Throughout this

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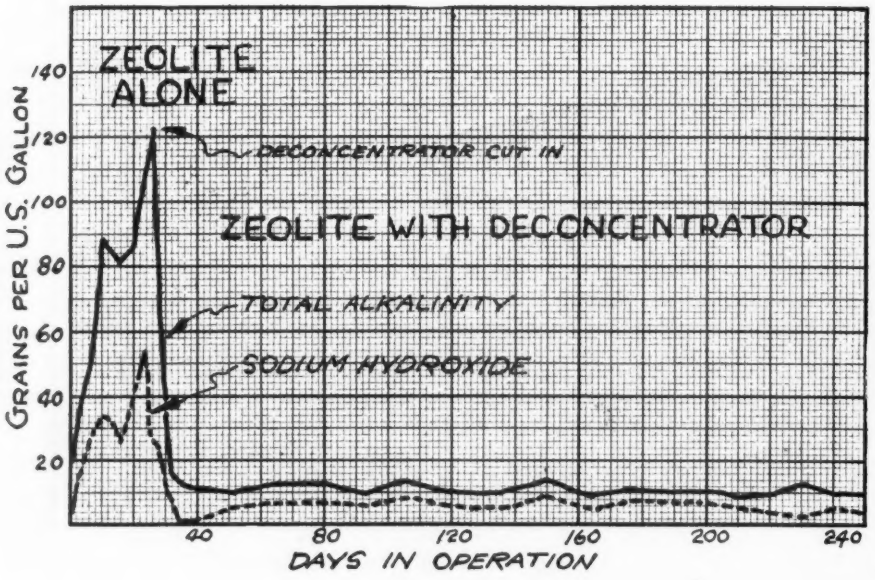

Figure 3

entire second period of 31 weeks the boiler water was kept in chemical balance, the alkalinity was kept low as shown in Figure 3, and blowdown was reduced about 60 per cent.

Practically all natural waters carry as impurities, a certain amount of sulfate salts. When boiler waters are properly treated to prevent the formation of gypsum or sulfate scale, sodium sulfate accumulates in the boiler.

When boilers are operated at 150 pounds pressure or less, at least as great an amount of sodium sulfate must be present as the total alkalinity, if embrittlement is to be prevented. In other words, the ratio of sodium sulfate to total alkalinity must be at least one to one.

If this ratio falls below one, embrittlement may be expected to develop in the boiler metal in the region of the riveted seams. If, however, the sulfate-alkalinity ratio is kept at a value greater than one, wide experience and scientific investigation show that embrittlement will not occur.

Figure 4 shows the sulfate ratio, first, when the make-up water consisted of zeolite softened water alone and, second, when the make-up water was a proper mixture of zeolite softened water and raw hard water.

During the first four weeks, when the straight zeolite softened water caused the building up of an excessive alkalinity, the sulfate ratio remained below one, in the embrittlement danger zone. Throughout the entire following 8 months, however, when the proper proportioning of zeolite softened water and raw hard water kept the alkalinity down to a minimum, the sulfate ratio became very much greater than one, where no danger from embrittlement exists.

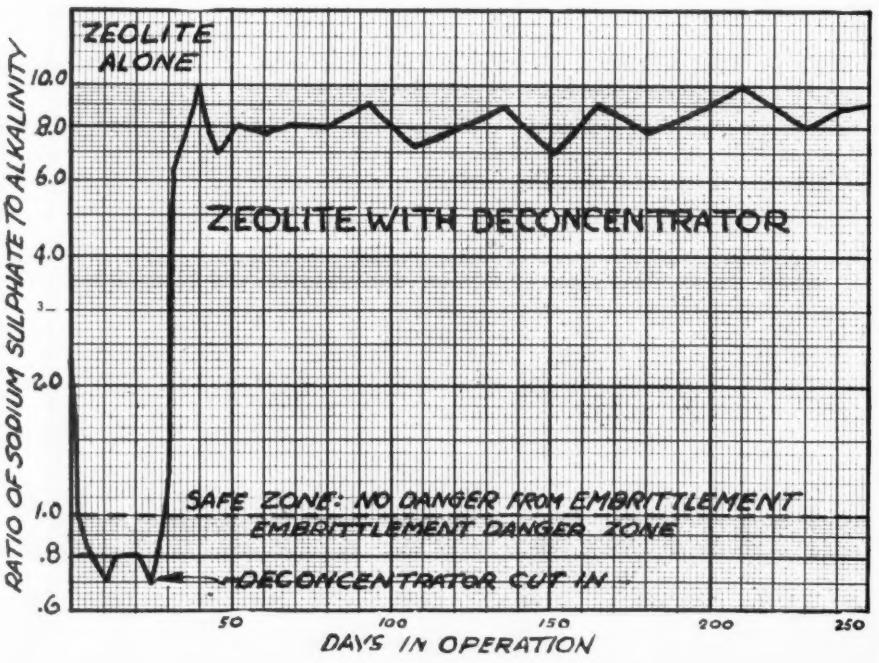

Figure 4

From this it will be seen that although a boiler fed with zeolite softened water for make-up will develop an excessive alkalinity, conducive to embrittlement, the same boiler, using the same water supply, and operated in the same way may easily be controlled and protected against all danger from embrittlement by the simple proportioning of raw hard water and zeolite softened water fed to the boiler. This proportion is determined by simple chemical tests made on the boiler water by the engineer.

When raw water is treated by lime and sode ash, or by other chemical precipitants, before being used for feed water, deconcentration is of special usefulness. Even after long reaction periods, followed by pressure sand filtration, considerable quantities of suspended matter are often carried to the boiler by the feed water.

Filtration is inefficient before an adequate layer of coagulant or "Schmutzdecke" has been built up on the surface of the sand. Rates of flow too rapid for complete clarification may be necessary to obtain an adequate voulme of water. The filter may be held in service after it has become overloaded with precipitate or after the sand particles have grown large and poorly adapted for filtration.

In addition to suspended solids reaching the boiler because of mechanical defects, there are colloids and dissolved salts that produce an after-precipitation in the boiler.

Lime-soda water softeners will reduce the calcium carbonate content to 3 to 5 grains per gallon in the cold process method. This quantity is equal to 4 to 7 pounds of sludge for each 10,000 gallons of water supplied to the boiler.

In boiler plants not equipped with deconcentrating apparatus, this material must be removed by the blowdown to prevent scale and congestion. The excess treatment used to produce maximum softening of the raw water in the lime-soda system likewise increases the quantity of chemicals reaching the boiler, further increasing the sludge and the concentration.

The use of deconcentrating equipment in combination with the lime-soda softener or similar precipitation equipment makes possible more definite chemical control of the water within the boiler and provedes for the continuous removal of the sludge, reducing blowdown and minimizing the caustic content within the boiler.

Internal Chemical Treatment

The chemical reactions taking place within a boiler due to the application of internal treatment have the advantage of more definite control than may be realized by external means of water softening.

As previously stated, those salts

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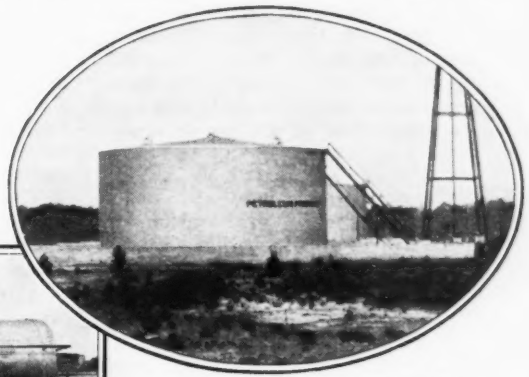

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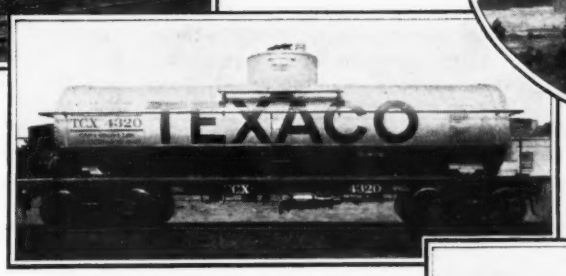

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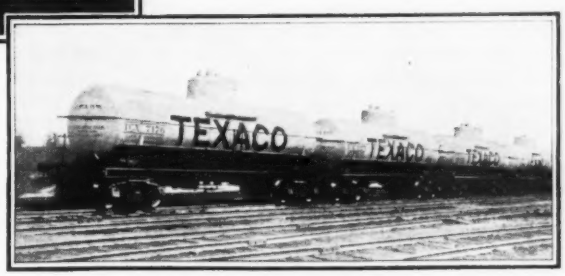

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found in natural waters have definite and specific properties under heat and pressure within the boiler. The use of boiler compound or the use of chemical reagents by a rule-of-thumb method or by guess, will not provide the chemical control required to maintain the boiler in a balanced condition.

The properly balanced boiler precludes the formation of scale, the corrosion of the boiler metal, embrittlement of the boiler plate, the excessive concentration of soluble salts and the accumulation of sludge or mud.

THE operating conditions, including the rate of evaporation, the temperature of the incoming feed water, the pressure at which evaporation takes place and the rapidity of production of insoluble matter are factors which play an important part in the maintenance of a correct chemical equilibrium.

A periodic examination of the incoming feed water to determine the chemical composition is inadequate to provide proper chemical control within the boiler.

Deconcentration makes the individual boiler the unit, in contrast to external water softening, which considers as the unit the entire boiler plant.

The success of correct internal treatment necessitates periodic examination of the boiler water itself to determine the chemical character of the water under the operating conditions within the boiler and to regulate the internal treatment in accordance with the chemical tests.

It is quite evident that the promiscuous use of cure-all compounds will not provide a balanced condition within the boiler and that it is necessary to use properly prepared chemical reagents, correctly applied to the boiler water, to realize the purpose of correct chemical control.

The application of appropriate chemical reagents direct to each individual boiler overcomes any deviation arising from irregular evaporation, changes in the incoming feed water or other variations in boiler operation.

The correct application of the proper chemicals to the boiler provides a definite and positive control to maintain within the boiler the proper equilibrium desired to produce a satisfactory condition for high efficiency in deconcentration and boiler operation.

It is vitally important to utilize suitable means for the application of the chemical reagents to the boiler. Irregular application or means which will not provide a uniform treatment of the boiler water may defeat the very object desired by a balanced condition.

The method for applying the chemical to the boiler water must be positive in operation and sufficiently flexible to maintain constant balance during variations in operating conditions.

A definite chemical balance is realized when a proper ratio has been established between the total hardness in the boiler water, the caustic alkalinity, the carbonate alkalinity, and other chemical substances in the boiler water.

Results of Deconcentration With Internal Treatment

A concrete example of the results obtained from deconcentration in boiler water purification is disclosed by an 87-day test on a 1000-horsepower Stirling boiler with proper equilibria maintained within the boiler by means of definite laboratory supervision.

The boiler was operated at an average load of 200 per cent of rating, thereby developing a total of 2000 boiler horsepower and operating at a working pressure of 320 pounds. The water supply was obtained from the Fox River which varied during the run in both total hardness and suspended solids. The total hardness of the water ranged from 8 to 22 grains per U. S. gallon. The total dissolved solids content ranged from 10 to 30 grains per U. S. gallon, and the suspended matter at times exceeded 200 parts per million.

Analysis of the raw water indicated approximately 90 per cent carbonate hardness and 10 per cent sulfate hardness.

Operating conditions were such that the feed water consisted entirely of raw water with no return condensate available.

During the time of the 87-day test, 22,000 pounds of sludge was withdrawn through the deconcentrating equipment. The maximum total solids concentration in the boiler water was 66 grains per U. S. gallon, and the average concentration 40 grains per U. S. gallon. The sodium hydroxide concentration reached a maximum of 7½ grains per gallon while the average caustic content was only 1.76 grains per gallon.

THE above results were obtained using an internal balanced treatment properly applied to the boiler water, the application of the treatment being proportioned in accordance with chemical tests on the boiler water.

It is interesting to note the results which would have been obtained under the above operating conditions with zeolite and with lime-soda equipment.

If all the water used during this test had passed through a zeolite softener the temporary hardness would have been changed to soda ash and caustic within the boiler. This condition would have caused a rapid concentration of soluble sodium salts, necessitating a high and wasteful blowdown with the potential danger of caustic embrittlement.

If on the other hand, the raw water had been softened by external treatment with lime and soda ash, the softened water would have carried to the boiler more than 40 pounds of sludge-producing salts per 24 hours, removal of which would have been accomplished by means of the wasteful blowdown method, and the over-treatment required would have created in the boiler a much higher caustic condition than found with the deconcentrating equipment and correct internal treatment.

The question arises concerning what deconcentration will accomplish with a water high in permanent hardness, wherein softening by either the zeolite or lime-soda method would change the permanent hardness to the sulfate, chloride and nitrate of sodium.

Deconcentration is not designed to remove the soluble salts of sodium, or other salts which will not produce sludge or suspended matter.

The use of a chemical which changes the permanent hardness to soluble salts of sodium defeats the object of deconcentration. Deconcentration is designed to remove continuously from the boiler water impurities in suspended form. It is therefore desirable to produce within the boiler, sludge or suspended matter, and any treatment which supports this objective increases the efficiency of deconcentration.

WATER high in permanent hardness can be treated by means of colloidal agents which collect those salts responsible for permanent hardness into a suspended floc and, as such, removal is accomplished by circulation to the deconcentrating unit.

The use of a balanced treatment which will precipitate the temporary hardness as sludge and a colloidal treatment which will unite the permanent hardness as a floc is the logical method to follow to overcome those waters containing large quantities of permanent hardness.

Under normal conditions the zeolite system and the lime-soda softener convert the permanent hardness to soluble sodium salts which concentrate within the boiler, necessitating blowdown for removal, whereas deconcentration converts both the temporary and permanent hardness into suspended sludge for removal in the deconcentrating system.

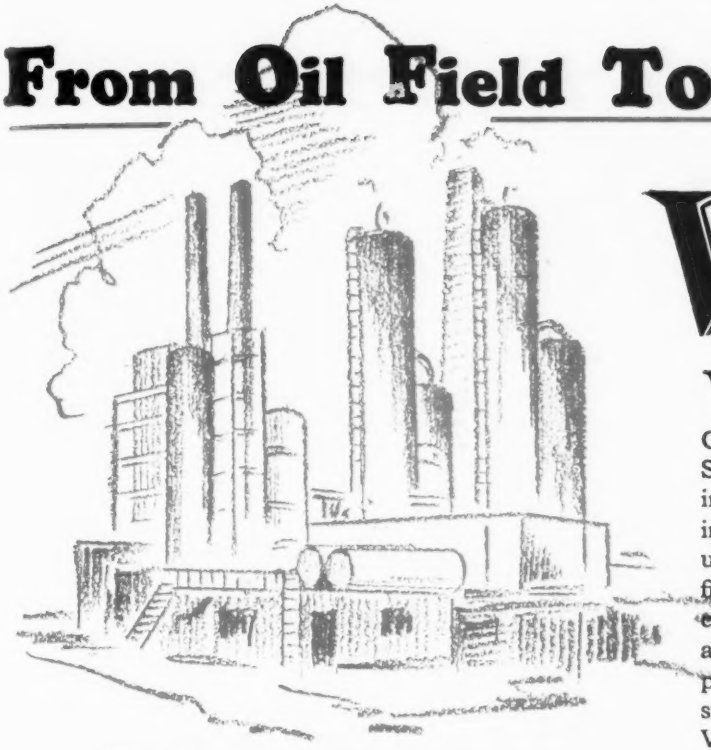
Conclusion

Deconcentration of boiler water functions primarily to maintain within the boiler a clean boiler water free from suspended solids, with a definite equilibrium established to minimize the quantity of caustic and to prevent scale formation.

It is vitally important to maintain within the boiler a correct chemical balance and to control the equilibria by means of tests on the boiler water itself.

The source of the means for providing the necessary chemicals to maintain the proper balance within the boiler is of minor importance, provided those reagents are suitable for the water and for the steaming conditions under which evaporation is taking place.

From Oil Field To Service Station



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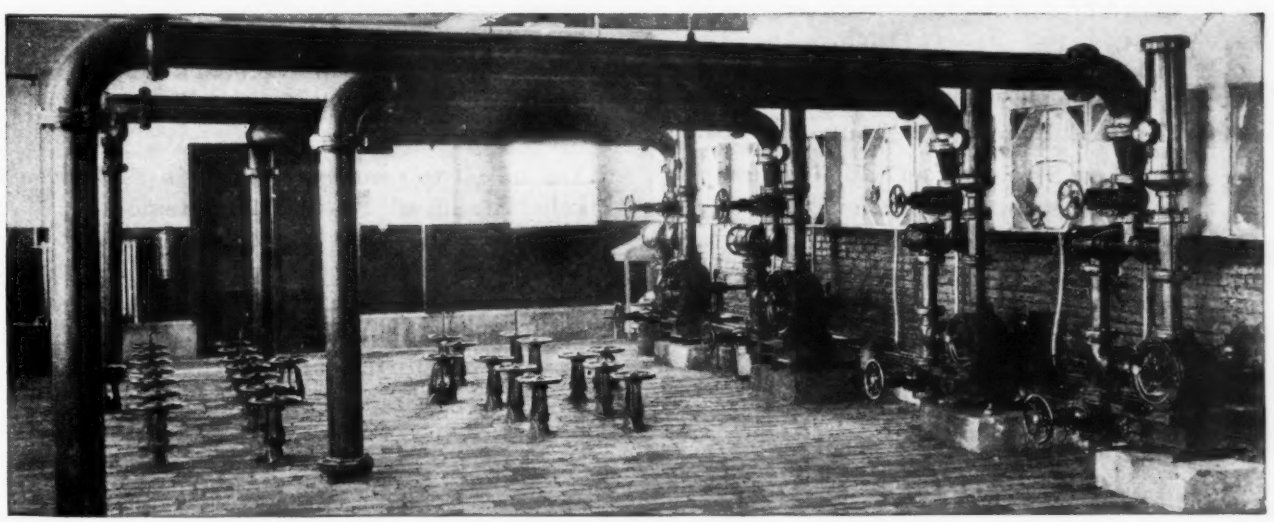

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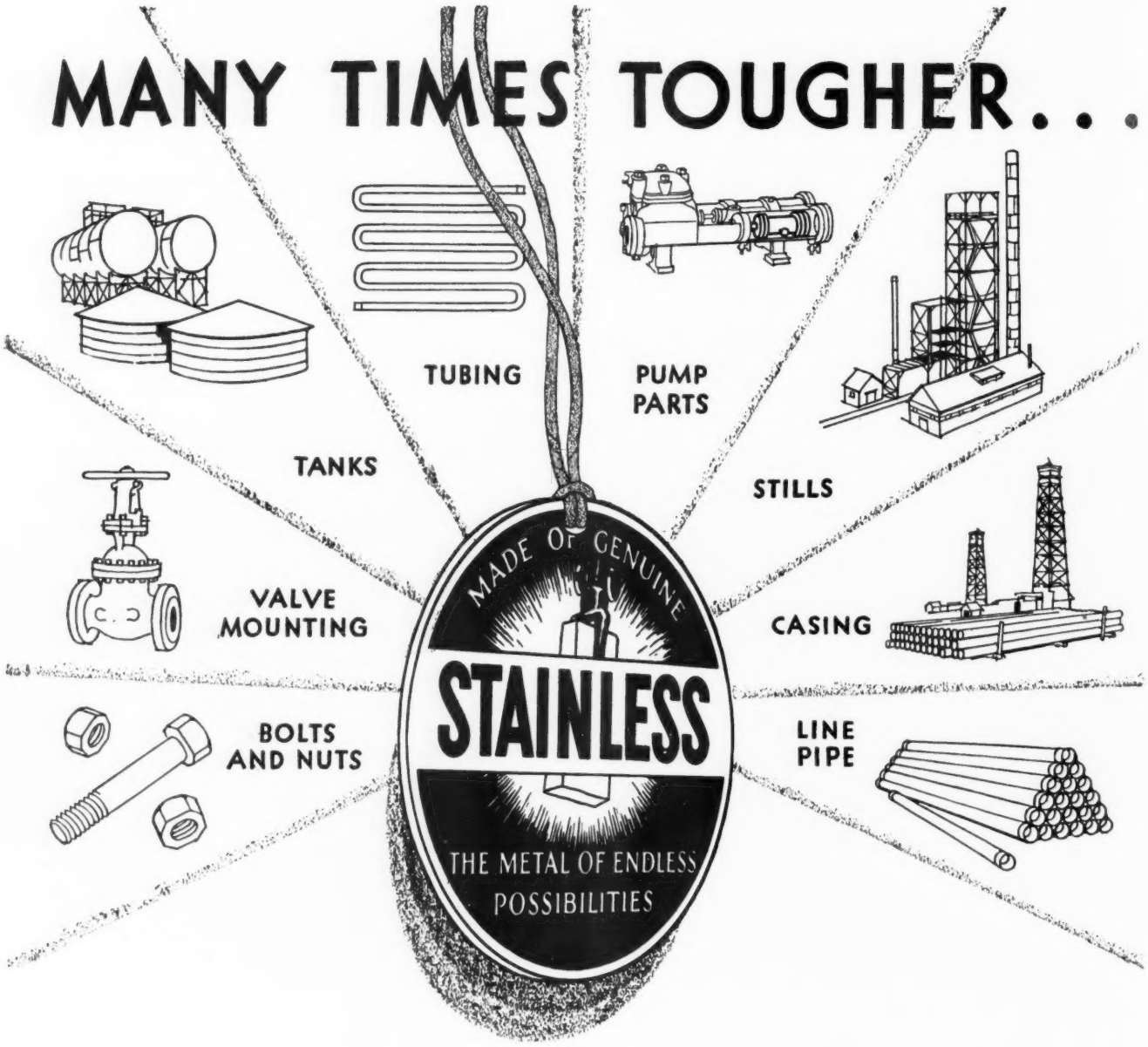

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Plenty of Good Water for the Refinery; How to Assure Dependable Supply

By I. A. Oliver

MODERN methods and equipment employed in the development of water supply systems for oil refineries have overcome many acute problems and greatly lowered operating costs. Although the requirements and facilities available will vary with local conditions, the main problem still remains the same.

Water is the most important element around an oil refinery, for boiler feed, condensing and cooling, domestic purposes and fire protection.

There must be an abundant and dependable water supply at all times and to obtain satisfactory results for any of these purposes the water must be pure, free from silt or sediment, preferably soft and free from alkalies and minerals.

The sources of water supply usually available to refineries may range according to locality as follows: Rivers and creeks; lakes and ponds; storage reservoirs; municipal water supply, dug wells and drilled wells.

Of all these sources of supply the most abundant and dependable may be obtained from drilled wells which will tap an abundant underground water supply available at all times, uniform in quality and temperature and in most cases entirely independent of the seasonal conditions which affect most of the open surface water supplies.

In refinery work, like any modern business enterprise, operating economy is of great importance and the question of source of supply will largely depend on the cheapest method by which good water can be obtained. It must be borne in mind, however, that although in many localities abundance of water is available from rivers and lakes it is found, nevertheless, that this water in some seasons of the year is unfit for use. Refineries bordering the great rivers of the southern states, pump all of their water supply from deep wells during most of the year because the water from the rivers is so warm as to be unfit for cooling or condensing purposes.

The water for boiler feed should always be of a uniform quality, free from sediments, impurities and minerals which cause boiler troubles such as heavy incrustation, pitting, scale, foam and priming.

Outside of these natural water supplies we might consider the municipal supply which is furnished to refineries within municipalities. There would probably be no objectionable factors regarding this supply except its high cost and since the operation of refineries must be conducted on an economical basis, the natural trend is to employ modern methods and equipment to obtain best results.

Immanuel Alvin Oliver was born near Dublin, Alameda Co. California. He was a natural genius along practical creative lines. Later he moved with parents to Santa Clara valley where he spent two years in developing water and drilling wells, here he also obtained an early knowledge of water pumps and pumping. Later he followed the mechanical trades at Joshua Hendy Iron Works, Ostenberg Manufacturing Co. and Bean Spray Pump Co.

In 1912 *he entered Santa Clara university and was graduated in* 1916, *in mechanical engineering, and spent one year additional as engineering instructor. Obtained his master degree in* 1921. *From* 1918 *to* 1923 *was employed at Bean Spray Pump Co., San Jose in various engineering capacities as plant engineer, hydraulic testing engineer and later chief hydraulic engineer in charge of pump design. He is a pioneer in the development of the water lubricated turbine pump, also in the development of the unidrive electric pump head.*

In 1923 *became associated with Pomona Pump Co. and developed the famous Pomona water lubricated deep well turbine pumps.*

Many modern refineries are finding an economical solution to this problem by drilling their own deep wells and installing modern deep well turbine pumps of high efficiency and dependable operating qualities, which assures them a constant, dependable and economical water supply.

The main source of underground water is derived from rainfall and melting snow. The water soaks into the ground and percolates through the upper soil and strata till it reaches an impervious formation where it will collect and flow along by gravity, gradually seeking the lower strata and finding its way to the underground sand and gravel channels and deep underlying strata of valleys and lower land.

The depth and location of these water bearing strata depend entirely on the geological formation and topographical character of the country.

The drilled deep well is not entirely of recent development. It has been used for many years for obtaining water supply from deep strata where the water is more abundant and usually of a better quality. This type of well eliminates surface water and water of upper strata which is often undesirable especially in localities where it has a tendency to be alkaline or hard. In most localities there are several water strata underground and the depth to which the well must be drilled depends entirely on local conditions and the quantity of supply required.

MOST deep wells are drilled by power machinery, using some one of the modern types of standard water well drill rigs. The type of drill rig best suited for any particular locality depends on the geological formation and water strata through which the well would be put down. For drilling wells in localities where the strata consist merely of deep beds of water-bearing sand, lying between ledges of hard clay, shale or lime formation, the hydraulic, rotary type of drill seems the most suitable.

The upper part of the well, usu-

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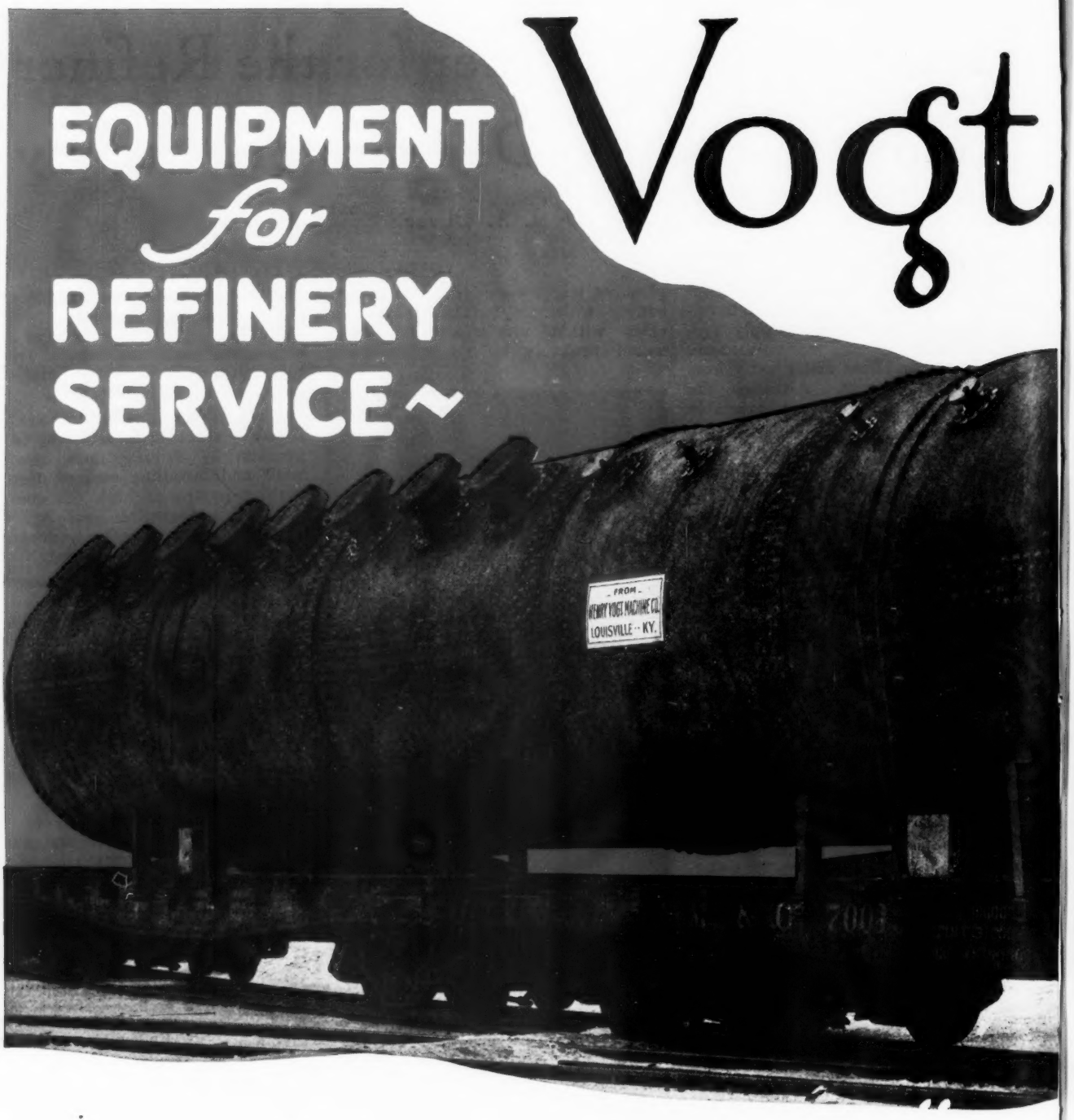

REACTION CHAMBERS — **REFLUX TOWERS**
DEPHLEGMATORS — **EXPANSION CHAMBERS**
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TAR SEPARATORS — **CRACKING CHAMBERS**

ally made 2 inches larger in diameter than the lower part, is cased with solid iron casing down to where the heavy water stratum begins. Beyond this point the hydraulic rotary bit bores out the hole and forces in thick mud to wall up the sides of the bore until the operation of drilling has been completed.

When a sufficient amount of water bearing sand has been penetrated and an anchorage is found in a ledge of hard formation the drill is withdrawn and a perforated casing of approximately 2 inches smaller in diameter than the upper casing is dropped down into the bottom of the well, the upper end of this perforated casing extending into the solid casing for several feet.

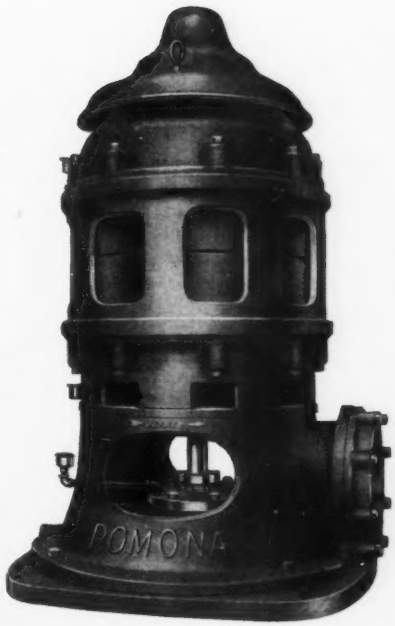
THIS type of well should be pumped and developed immediately after it is finished and before the mudded walls set too hard. In development of these wells this mud is pumped out with the fine silt from the surrounding strata. This type of well makes a very satisfactory water supply where available. However, it is advisable to drill down to a deeper stratum to avoid receding water levels.

In low land localities where the soil formation is mostly adobe or heavy alluvial clay with strata of fine silt or shale, the rotary drill using auger bit and rods is the best type of well rig to use. The well casing generally follows down close to bottom of bore as this formation has a tendency to collapse. Water bearing sand or fine gravel is usually encountered after boring through 3 or 4 feet of hard lime formation. These shallow water strata in low land regions do not yield much capacity, and often produce artesian flow in the wet seasons.

In most localities the standard well rig using the drill bit for hard formations and rock and the standard bucket and cable for general purposes makes the best all around drilling equipment for deep water wells. With this type the casing usually follows closely after the drilling operations except where the formation is hard enough to stand up under the action of the tools.

In drilling deep water wells it is always found best to play safe and start the well at the surface with a large enough diameter so, when casing gets stuck and the next smaller size casing must be used to continue the drilling operations, that, when the well is finally finished it will be of a sufficient diameter to make possible installation of a pump having a bowl diameter of ample size to produce the required capacity with the highest efficiency.

In this type of well, the bottom of casing is usually anchored in clay or else the end is cemented closed. The casing is then perforated at the various strata desired. A special perforating tool is operated from the surface. In some localities, owing to the extreme fine water sand, special well screens have to be put down and cemented in place.



Pomona Westinghouse discharge head deep well pump

The gravel-packed well or "gravel envelope" is used in some localities where the sand strata are such as to prevent the free flow of water without sanding up the well. In this type of well a much larger outside casing is first put down to the water sand strata, then the well casing approximately 4 inches smaller diameter is put down inside of this and graded gravel is poured down in between the two pipes. This gravel "envelope" runs into the sand stratum and forms a coarse screen around the well casing, which has been heavily perforated.

This type of well when properly built will yield much larger capacities and stand heavier pumping than any ordinary well of its size.

A very notable type of equipment for this class of well is the concrete well screen and concrete well casing built by Kelly Well Co. of Grand Island, Nebraska. An iron well casing is first put down of a size 6 inches to a foot larger than the outside diameter of the concrete well casing and screens. After the well is drilled and the various strata are carefully logged, the concrete sections of screen and solid casing are let down into the well, guided and supported in place by four steel cables running through holes cored vertically through the walls of the concrete sections.

After these are in place, selected screened gravel is poured in between the outer casing and concrete casing. While the gravel filter is being placed, the outer casing is being removed; thus when the well is completed only gravel and concrete remain in the ground. Only water bearing strata which are desirable are screened while the clay and undesirable strata are blanked off by packing with clay instead of gravel. These wells will yield very large capacities and will last indefinitely.

A new well is usually developed as soon as possible after it is completed. It is started off easy—by adjusting the pump or "choking back" the discharge to deliver a reduced capacity. All new wells will develop some sand in clearing up the strata and the pump is not stopped so long as it is delivering large quantities of sand—lest it "sand up" the well.

If the well clears up quickly and does not develop the amount of water expected—this can often be loosened up by the "surging process." The pump is started up and pumps full stream for a few minutes. It is then stopped and the water in the discharge column is allowed to run back into the well.

Then the pump is started up again and pumps another few minutes or until water clears up again. This process repeated several times will usually start the sand and silt flowing which opens up the strata in the well. Good judgment is necessary, however, to avoid carrying this process to the extreme. After surging, if well delivers muddy water, pump is allowed to run and water to clear up before surging again.

In general it is found that the type of well most suitable, and process of drilling and developing will vary with different localities and usually some reliable local driller who thoroughly understands these problems is employed with good success.

PUMPING equipment for deep water wells has, in recent years, undergone considerable development and has reached a high state of perfection in performance and dependability. The choice of pump used in deep wells depends largely upon the locality, the kind of well and the service expected. Most common types of pumps used in deep wells are:

The centrifugal turbine deep well pump. The plunger or displacement type of deep well pump, and the air lift. Of all types, the deep well turbine pump is rapidly gaining greater popularity and favor among water users owing to its many valuable features.

This type of pump consists of a discharge head adapted to mount the motor or belt pulley and fitted with a surface discharge opening. This is mounted on a foundation at the surface of the ground, a discharge col-

umn and drive shaft extends down into the well at the lower end of which the turbine pump unit is attached.

This unit is composed of several stages, depending on the head against which the water is to be delivered and this is usually submerged below the lowest pumping water level in the well. In this way the pump is always primed and with ample submersion to take care of varying water levels.

Deep well turbine pumps are made in all sizes, as small as 3⅝ inches in diameter, to be installed in 4-inch wells, and having a capacity of from 15 to 50 gallons per minute, up to pumps having an outside diameter of 23 inches and larger suitable to be installed in wells of 24 inches or larger, and having a capacity of 4000 to 5000 gallons per minute and larger.

As the efficiency and performance of the pump depends largely on the diameter of the well available, drillers usually recommend the size of well in which can be installed a pump unit, or bowls of ample diameter to deliver the required capacity at moderate economical speeds and at the highest efficiency. The production of water for any purpose is always done in the most economical way and it has been found that the choice of a pump unit for any given requirements is a matter of good engineering and careful investigation.

There are many deep well turbine pumps on the market today which have proven their reliability and good qualities for dependable service, low unkeep and high efficiencies.

The type of drive to be used depends largely on the locality and the kind of power available. In sections where natural gas is available or in plants where gas is a by-product, or is very plentiful, the gas engine is used to great advantage. The first cost of the power unit with its auxiliaries is the biggest item to be considered as the fuel cost would be very nominal.

FOR this type of power the deep well turbine pump would be operated by a belt drive and in some cases these power units have been directly connected to the pumps by a geared head. In later years the diesel engine has come into general usage, and owing to the fact that it uses a cheap grade of fuel oil it makes an economical power unit for refinery work.

Steam power is always readily available around refineries and this is used for power purposes in many pump installations. However, the steam engine is not an economical power plant, therefore it is not as popular as gas, oil or electricity.

Electric driven turbine pumps are the latest developments in this line. In the most modern types the motor is built into the pump head making a symmetrical compact unit. The pump shaft extends up through the rotor and all pump adjustments are made at upper end of the motor. Suitable bearings are mounted in this head construction to take care of the radial and thrust loads and oiling facilities are entirely self-contained and automatic and have been developed to a high state of perfection. Although electric power costs slightly more than gas or oil power, it has many advantages over any other kind of power wherever it is available.

In a refinery having several wells located at various points in the property, the electric driven unit is considered by far the best. In refineries that generate their own electric power by natural gas or oil engine power, the electric driven pump presents a much better power distributing problem. The electric power is distributed to the various plants and the pumps can be started and stopped from a central operating station.

THE following example of a typical deep well turbine pump installation may be used in comparing relative costs.

Equipment

Electric—Direct driven deep well turbine pump, to pump 1000 gallons per minute against a total head of 200 feet.

To operate at best efficiency requires a well diameter of at least 14 inches or better 16 inches. This will be a 75 horsepower, 1160 revolutions per minute, electric driven turbine using the latest type Unidrive head.

Cost of complete unit, installed and wired up, will average $3750.

Cost of Power

Supplies, attendance and overhead for each 24-hour day:

Attendance	$ .10
Oil and supplies	.05
Up keep—on basis of $200 per year	.55
Depreciation @ 5% on $3500 assuming that plant will last 20 yrs.	.48
Interest on investment $3750 @ 6%	.62
Per 24-hour day	$1.80
Per hour	.075

Cost of Electric Power

Cost of electric power. 110 KW. hr. @ One Cent per KW. Hr.	$1.100
Total cost of operating and maintaining plant—per hour	$1.175

For 1000 gallons per minute; 60,000 gallons per hour, the total cost per 1000 gallons is only $.0196.

Deep well turbine pumps are divided into two general classes:

The oil lubricated pump with bronze bearings in which the oil is allowed to leak out into the well after it passes down through the bearings.

The water lubricated pump with rubber bearings in which water is the only lubricant used. Of these two classes, the water lubricated pump stands out as the greatest advance in modern deep well pump design.

THIS type of pump uses live vulcanized rubber bearings throughout—from top to bottom. All the bearings in the pump bowls also up the discharge column at short intervals, rubber bearings support the pump and drive shaft in a central, vertical position constantly lubricated in the very water which it is pumping.

When live vulcanized rubber is wetted with water it becomes very slippery and forms an ideal bearing, offering wonderful wearing qualities against sand and grit. With this construction all parts coming in contact with the rubber bearings are made of rustless, noncorosive materials.

The general usages of water in a refinery are such that oil or grease contaminating the water supply is very objectionable, troublesome and expensive. It produces feed water and boiler troubles, clogs up and reduces the efficiency of condensers and cooling systems, piping and meters.

It is also highly objectionable and unpalatable for domestic consumption. Water lubricated turbine deep well pumps deliver water into the main supply system just as it comes from the flowing stratas and without even a trace of oil or grease. This type of pump does not require constant attention to oil lubrication. The only oil used is in the motor and head bearings assembly and this is automatic in a sealed oil bath. These pumps operate over long periods with very little attention of any kind.

The water lubricated deep well pump, an achievement of recent years is rapidly being recognized as the ideal water pump for refineries. Many well known, large oil refineries throughout the country are using this type of pump with great success.

PITTSBURGH, Pa., Oct. 28.—A booklet containing new and useful tables for calculating the quantities of brick required for arches of different spans and thicknesses has been published by Harbison-Walker Refractories Co., here, under the name of "Firebond."

It tells of the use of Firebond for making joints stronger in brick work, how it cuts furnace maintenance costs, and tells how to mix and use it. It can be used in refinery stills and oil burners.

How Aluminum Towers Stand the Gaff In Refining High Sulfur Crudes

By Dr. Sidney Born*

FOR many years the equipment used by the petroleum refining industry has been largely confined to materials manufactured from wrought iron or steel, cast iron and cast steels. Bronzes and brasses have been used mostly for valves, and more lately we have seen the introduction of nickel-chromium alloys for various purposes.

Certain developments, however, in the last few years have demanded properties which the above materials do not have. The peculiar physical and chemical properties of aluminum and its alloys make it particularly suitable for certain types of apparatus used in the petroleum refining industry. Our attention was first directed to this material on account of its resistance to hydrogen sulfide.

Many crude oils now being produced contain more or less hydrogen sulfide, mercaptans, organic sulfides and other sulfur compounds, which in some cases react very quickly with the ferric metals.

In our preliminary experiments, commercially pure aluminum was used for our tests. Alloys of aluminum and manganese; aluminum, copper, manganese and magnesium; and aluminum and silicon were also used in our tests. The physical properties of these alloys are given in table "A" herewith.

During the latter part of 1927 and the early part of 1928, a great many experiments were carried out to determine the resistance to corrosion of various metals with West Texas crudes containing approximately 2.0 per cent sulfur. The method of carrying out the experiments was briefly as follows

A bank of 24-inch Liebig condensers was set up attached to a 1000-cubic centimeter short neck boiling flask. Each cork with which the condenser is attached to the flask is provided with two holes, one for the condensers and the other for a thermometer. A small wire hook is pushed into the bottom of each cork as a means to keep the metal strip suspended in the vapors, the metal strip being fastened to the wire hook by means of a thread to avoid any electrolytic action.

To keep the temperature of the tests as nearly alike as possible, a constant temperature bath was constructed and filled with cylinder oil,

*Assistant General Superintendent Refineries, Transcontinental Oil Co.

Table A

ACOA* Symbol	Composition	Ten. Strength Lbs. per Sq. In.	Yield Point Lbs. per Sq. In.	Elong. % in 2"	Remarks
2SH	Commercially Pure Alum. 99% Plus	20,000	18,000	15	Hard Rolled
3SH	Al-Mn	31,000	28,000	11	Hard Rolled
3S4	Al-Mn	23,000	22,000	16	Approx. Half Hard
17ST	Al-Cu-Mn-Mg	60,000	34,000	24	Duralumin Heat Treated
No. 43	Al-Si	19,000	15,000	5	Free flowing alloy for sand casting

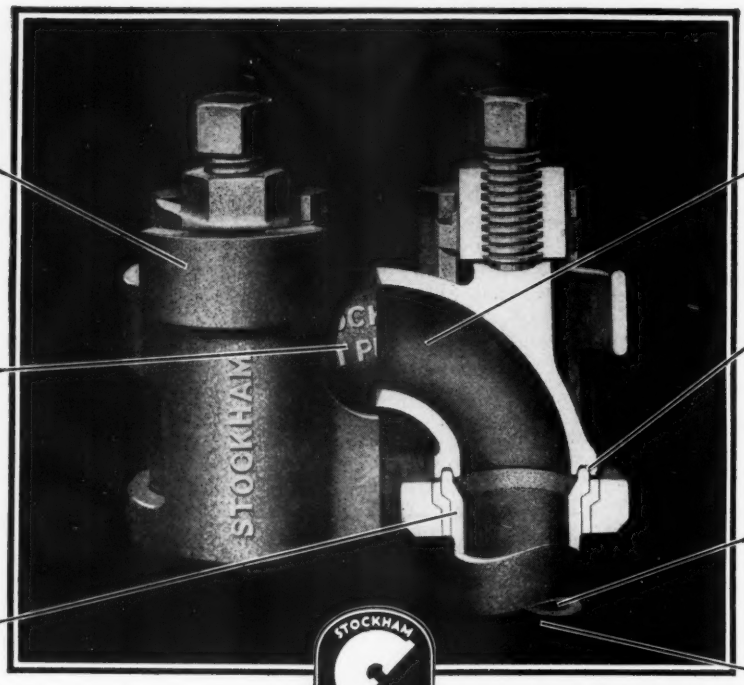
*Aluminum Co. of America

Table B

Showing Loss as Per Cent Weight of the Eight Metals Used

	In Vapors				In Oil			
	Time	Tempt.	%Loss	Avg. % Loss	Time	Tempt.	% Loss	Avg. % Loss
Sample 1 Aluminum	24 hours	280	Nil		24 hours	390	Nil	
Sample 2 Aluminum	24 hours	280	Nil	Nil	24 hours	390	Nil	Nil
Sample 3 Aluminum	24 hours	283	0.0139		24 hours	392	0.0146	
Sample 4 Aluminum	24 hours	283	0.0132	0.0135	24 hours	392	0.0133	0.0139
Sample 1 Brass	24 hours	285	0.0135		24 hours	390	0.0242	
Sample 2 Brass	24 hours	285	0.0163	0.0149	24 hours	390	0.0090	0.0176
Sample 1 Stainless Steel	24 hours	286	0.0138		24 hours	397	0.0110	
Sample 2 Stainless Steel	24 hours	286	0.0238	0.0188	24 hours	397	0.0158	0.0134
Sample 1 Cast Iron	24 hours	282	0.0235		24 hours	395	0.0169	
Sample 2 Cast Iron	24 hours	282	0.0328	0.0281	24 hours	395	0.0244	0.0206
Sample 1 Galvanized Iron	24 hours	288	0.0276		24 hours	395	0.0498	
Sample 2 Galvanized Iron	24 hours	288	0.0307	0.0291	24 hours	395	0.0339	0.0418
Sample 1 Admiralty Metal	24 hours	283	0.0585		24 hours	390	0.0428	
Sample 2 Admiralty Metal	24 hours	283	0.0682	0.0633	24 hours	390	0.0641	0.0534
Sample 1 Spring Steel	24 hours	288	0.0869		24 hours	394	0.0207	
Sample 2 Spring Steel	24 hours	288	0.0571	0.0720	24 hours	394	0.0254	0.0230
Sample 1 Copper	24 hours	284	0.2498		24 hours	390	4.587	
Sample 2 Copper	24 hours	284	0.4362	0.3425	24 hours	390	4.776	4.681

The Stockham Fantz-Type Return Bend will do everything any other bend, junction-box, etc., can do, and many important things some cannot do!


MANY TIMES NECESSARY STRENGTH IN YOKE ASSEMBLY WITH NO EXCESS WEIGHT
U-PIECE ONLY PART IN CONTACT WITH HOT OIL
NO IMPAIRMENT OF STRENGTH – NO COLD ROLLING AT TUBE BANK
SMOOTH STREAM-LINE FLOW REDUCES FRICTION SAVES POWER--KEEPS BEND FREE FROM COKE
RING JOINT WILL NOT LEAK, AND DOES NOT COKE TIGHT
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Every Stockham Fantz-Type Return Bend is tested to 2½ times rated working pressure on a specially designed plate, which also checks centers and joints.

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RETURN BEND

THERE IS A STOCKHAM FITTING FOR EVERY OIL REQUIREMENT
ELECTRIC CAST STEEL—CAST IRON—MALLEABLE

the flask being immersed in the cylinder oil.

The loss in weight of the various metals was determined in one series of experiments with the strips suspended in the vapors as outlined above, and in another set of experiments, the strips were immersed directly in the oil.

The results of this series of tests is tabulated in the following Table B.

This series is representative of a great number of tests carried out under similar conditions. Another series of tests was carried out over a long period of time with the strips of metal immersed in the oil and suspended in the vapors at room temperature. These tests were carried out as follows:

Ten one-half gallon samples of crude oil were placed in 10 separate 9-pound bottles. In each half-gallon sample, weighed metal strips 1/32-inch thick, ½-inch wide, and 2½ inches long were placed as follows: Three strips above oil in vapors, and three strips suspended in the oil. The mouths of the bottles were allowed to stand open so the vapors might escape freely at room temperature which approximated 85 degrees for 30, 60 and 90 days, the length of tests, after which the strips were removed carefully, weighed again and per cent loss by weight determined.

The five metals used are as follows; aluminum, cast iron, brass, steel and copper.

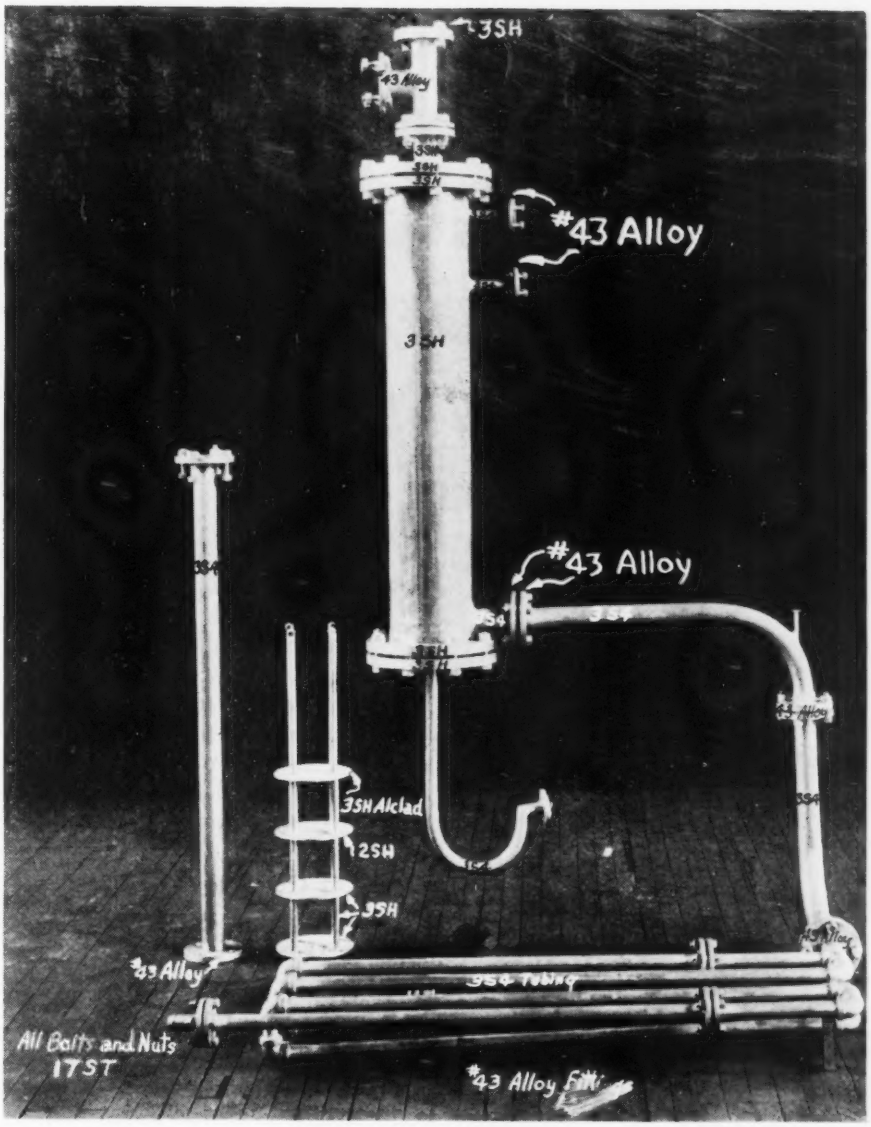
About the same time these tests were being carried out, it was decided to determine the adaptability of aluminum to refinery work on a slightly larger scale. Two 1-barrel stills were constructed, each still provided with a vapor line, fractionating tower and condenser coils.

The stills, in both cases, were constructed of steel in the usual manner, but in one case the vapor line, tower and coils were constructed of steel, and on the second still, the vapor line, tower and coils were constructed of aluminum.

A photograph of the aluminum vapor line, tower and coil is shown herewith. Various alloys of aluminum were used in this set-up, as it was desired to obtain as much data as possible under the conditions encountered. The physical properties of the various alloys may be obtained by referring to Table "A" given in the earlier part of this paper.

Both stills were run simultaneously for a period of approximately 9 months, the stills being charged practically every day with various crudes. Both sweet crude and those high in sulfur content were used to make various runs.

At the end of this period the two stills were dismantled and a thorough inspection was made of the tower, coils and vapor lines. Due to the intermittent service and the various crudes used, we consider that it was a very severe test on the equipment.



Tower, piping and fittings of aluminum used in test described. Here is the key to figures used on the cut: 2SH is commercially pure aluminum; 3SH is aluminum manganese alloy; 3S4 is another aluminum manganese alloy; 17ST is aluminum-copper-manganese-magnesium alloy; No. 43 is aluminum-silicon alloy

When the stills were taken apart, it was found that the steel tower and coils had been subjected to considerable corrosion. The steel tower, particularly, showed considerable corrosive action, the bubble tray plates being covered with rust and scale, and the thickness of the metal being considerably reduced.

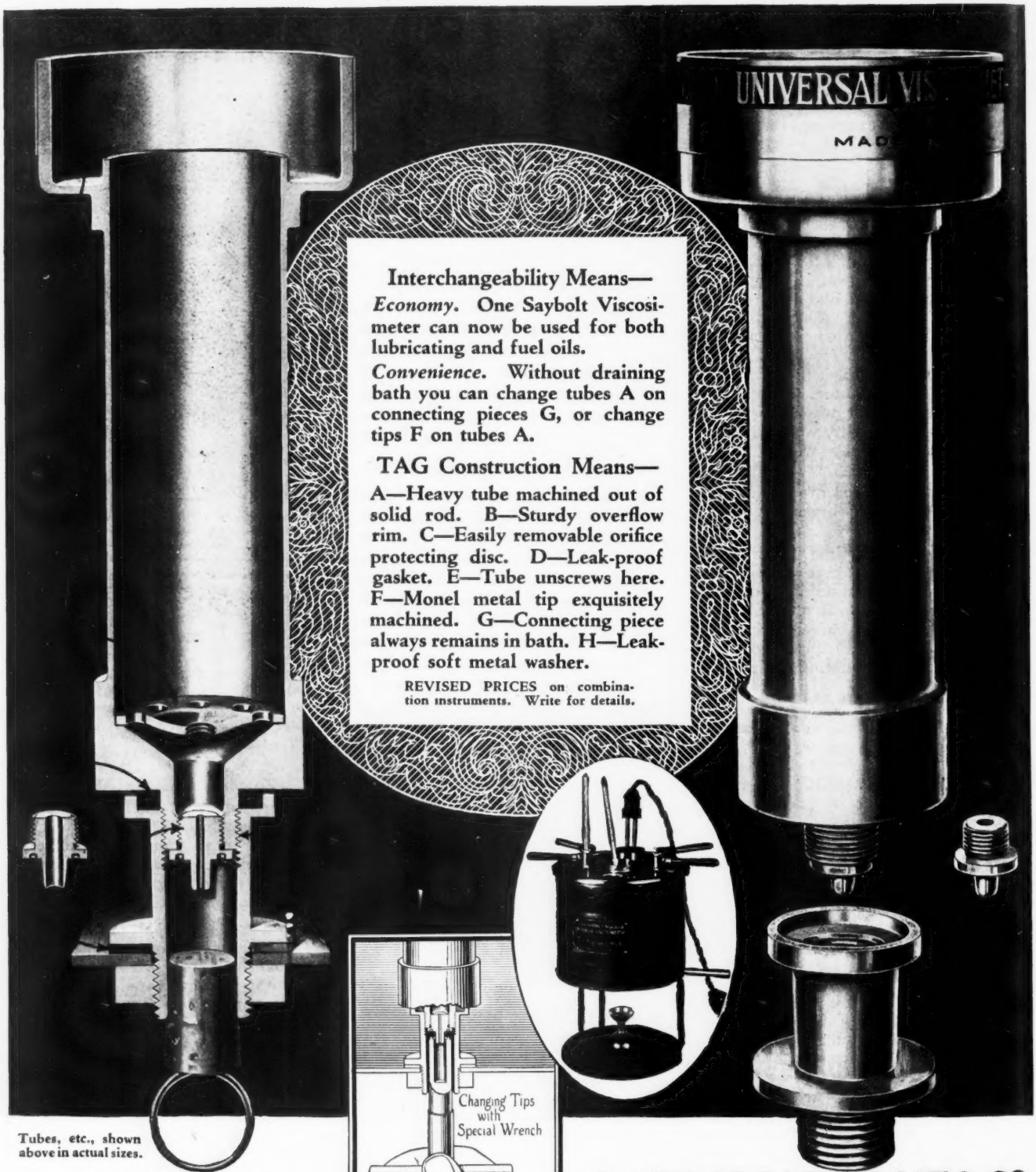
The aluminum equipment was apparently in as good shape as when it was first installed. We could detect no signs of corrosion in the vapor line or tower, the only noticeable action being a slight corrosive action on the outside of the aluminum coils, and this was undoubtedly due to the fact that the condensing water used for cooling these coils was highly alkaline.

The results obtained were so satisfactory that it was decided to equip an entire tower at one of our plants with aluminum bubble caps in place of the usual cast iron or steel caps. These bubble caps were cast from an aluminum silicon alloy and were much lighter than a cast iron cap of the same size.

The aluminum caps weighed about 1½ pounds, whereas a cast iron cap of the same pipe size weighs from 7 to 8 pounds. We found that it was considerably easier to install these aluminum caps instead of cast iron caps on account of the difference in weight. After the caps had been in service about a year, they were inspected and to date no corrosive action has been apparent.

Another place in the refinery where we have found we could use aluminum to advantage is in swing lines on loading racks. The ordinary swing line used for loading cars weighs from 70 to 80 pounds, and at times it is

SAYBOLT AND FUROL — ALL Now Fully Interchangeable — TUBES AND TIPS



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TAG Construction Means—

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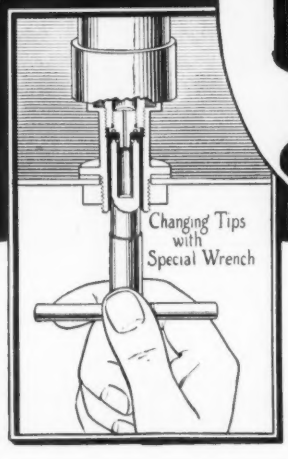

Tubes, etc., shown above in actual sizes.

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rather difficult for a man to handle these to advantage.

By making the swing line of aluminum pipe, we were able to cut this weight down to about 30 pounds, making it much easier to handle, also particularly desirable for loading refined oils such as gasoline and kerosene, due to the fact that the pipes do not rust like iron or steel pipes.

Aluminum is also particularly adapted for the manufacture of heat exchangers on account of the high conductivity of this material and its light weight, and is finding extensive use for this purpose where the temperatures do not exceed 600 degrees F. At the present writing over 50 of thse exchangers have been built and are in continuous service.

While the use of aluminum for the manufacture of equipment used by the refining industry is still in its infancy, we look for considerable development along this line, especially when the properties of aluminum and its various alloys are more extensively recognized. The cost of aluminum equipment will, in most cases, be only slightly higher than the cost of steel, because the weight of aluminum plates and tubes is approximately one-third that of steel of the same cross sectional area. The salvage value of aluminum scrap is considerably higher in proportion than steel or cast iron.

30-60-90 Day Corrosion Tests

Temperature Approximately 85° Avg.

Table C Showing Loss as Percent by Weight of the Five Metals Used

Sample No.		Time	In Vapors % Loss	In Vapors Avg. % Loss	In Oil % Loss	In Oil Avg. % Loss
Aluminum	1	30 Days	Nil		Nil	
	2	30 Days	Nil	Nil	Nil	Nil
	1	60 Days	Nil		Nil	
	2	60 Days	Nil	Nil	Nil	Nil
	1	90 Days	Nil		Nil	
	2	90 Days	Nil	Nil	Nil	Nil
Cast Iron	1	30 Days	0.0073		Nil	
	2	30 Days	0.0056	0.0064	0.0037	0.0018
	1	60 Days	0.0112		0.0018	
	2	60 Days	0.0091	0.0101	Nil	0.0009
	1	90 Days	0.0360		0.0410	
	2	90 Days	0.0267	0.0313	0.0405	0.0408
Steel	1	30 Days	0.0047		0.0049	
	2	30 Days	0.0098	0.0072	0.0095	0.0072
	1	60 Days	0.0099		0.0133	
	2	60 Days	0.0200	0.0149	0.0101	0.0117
	1	90 Days	0.2733		0.1789	
	2	90 Days	0.2060	0.2396	0.1916	0.1852
Brass	1	30 Days	0.0001		0.1934	
	2	30 Days	Nil	0.0001	0.2021	0.1977
	1	60 Days	0.0037		0.432	
	2	60 Days	0.0036	0.0036	0.439	0.435
	1	90 Days	0.0779		0.754	
	2	90 Days	0.0892	0.0835	0.887	0.820
Copper	1	30 Days	0.0992		0.0062	
	2	30 Days	0.0327	0.0659	0.0087	0.0079
	1	60 Days	0.1846		0.1310	
	2	60 Days	0.0456	0.1151	0.0383	0.0346
	1	90 Days	0.0542		0.0853	
	2	90 Days	0.0286	0.0346	0.2013	0.1433

Mix Dyes with Benzol Before Coloring Gasoline

By E. S. Wittnebel*

THE subject of coloring gasoline is today foremost in the mind of nearly every refiner.

The idea of coloring gasoline and other petroleum products probably originated in China or India. In the high altitudes of these two countries small railroads are operated by gasoline and kerosene engines and it was found that the natives were rather fond of these fuels and appropriated them for their own use.

The authorities had considerable trouble to check these thefts and to bring the culprits to justice until they hit on the idea of coloring these fuels red. From then on everyone found with red gasoline or kerosene in his possession was severely punished.

Later, we find that some of the railroad companies and large trucking and bus companies in the United States colored their gasoline stocks to prevent thefts.

The largest refiners soon saw the advertising value of colored gasoline.

During 1923 and 1924 the Bureau of Mines in Washington experimented with colors in gasoline. They found that certain aniline dyes free from impurities were the most suitable. These dyes are coal tar derivatives and consequently are closely related to gasoline. They have no effect on the quality of the gasoline or its combustibility.

The most important property to look for in a color for gasoline is solubility and absence of coal tar. Colors must be pure and free from adulterants. They should also have fair fastness to light, as colored gasoline is often exposed in glass vessels on top of gasoline pumps.

The use of improper dyes will result in impure gasoline and cause trouble in feed pipes and carburetors. Only colors which are perfectly soluble in gasoline should be used, even though the majority of marketers of colored gasoline do not dissolve the colors directly in gasoline. In order to speed up the coloring operation and to obtain uniform results, colors are generally dissolved in benzol. This benzol solution should be made in concentrated form and then diluted with the volume of gasoline necessary to obtain the desired shade.

The most commonly used dyes are red, orange, yellow, blue, green and combinations of these colors.

The amount of color to use depends on the depth of color required. To illustrate this point let us quote a few examples.

Gasoline No. 1—3 pounds of color in 10,000 gallons of gasoline, previously dissolved in benzol.

Gasoline No. 2—4½ to 5 ounces of color in 8,000 gallons of gasoline.

Gasoline No. 3—1 pound of color in 10,000 gallons of gasoline.

Gasoline No. 4—1 pound of color in 40,000 gallons of gasoline.

It can readily be seen from these examples that the colors are used to suit individual requirements and that some brands of gasoline are actually colored while others are only tinted. Tinted gasoline in a small vial or bottle appears almost colorless but the same gasoline in a 5 or 10-gallon cylinder on top of a gasoline pump will show a distinctive color.

Large refineries and other concerns have been found to be very secretive about their methods of coloring, colors used, etc. Therefore it must be left

*President, Commonwealth Color & Chemical Co.

to the individual to work out his own method and to find the quantities best suited for his requirements.

In general, it might be said that the most practical way for the refiner is to first find the amount of color needed to give him the shade and depth wanted in his gasoline. With a few experiments this quantity can easily be determined. Then dissolve this amount of color in a barrel with sufficient benzol to make a saturated solution and finally strain this solution through a cheese cloth or fine mesh wire screen into the tank, preferably when the tank is empty or nearly empty.

The tank is then filled and the stream of the incoming gasoline is sufficient to agitate and thoroughly mix the colored benzol and gasoline to obtain uniform results.

In closing, just a few words about the cost of coloring. The colors generally used range in price from about $1 to $7 per pound and it will readily be seen that even at $7 per pound the cost of coloring per gallon of gasoline is so small that it is almost negligible.

Non-Corrosive Alloys Helping Refiners Meet Severe Operating Conditions

By C. C. Snyder* and J. F. Brett**

COMPREHENSIVE investigations of corrosion losses have long been the order of the day in the laboratories of leading oil companies. While the broad problem of corrosion has been attacked from nearly every conceivable angle, only two possible solutions seem to have achieved any degree of general acceptance in the discussion of corrosion as it affects the oil refinery.

The first of these methods deals with treatment of the oil to prevent, insofar as possible, corrosion occurring farther along in the apparatus. The second recommends the use of materials serviceably resistant to the definite types of corrosion encountered in various parts of the apparatus. A third method, consisting of a combination of these two, naturally suggests itself.

Since methods of treating the crude are beyond the province of this article, the following data will deal with the use of the non-corrosive ferrous alloys. Of outstanding interest in this field has been the development of the straight high-chromium alloys and later the high-chromium, high-nickel alloys.

One of the most immediate and serious corrosion problems has existed in cracking stills handling corrosive crudes, the problem being still further complicated by the tendency of operators to employ increasingly higher pressures and higher temperatures. At the present time the widest application of these alloys has been in tubular form in an attempt to meet the above set of conditions. Generally speaking, the corrosion encountered here has been due largely to the formation of H_2S, a type of attack which is being satisfactorily met by the straight chromium and chromium-nickel alloys.

The first type of alloy used in this connection was a 12 per cent-14 per cent chromium iron with a carbon content of approximately 0.10 per cent. This type is a modification of the stainless steel used for cutlery. The next step was the trial of a higher

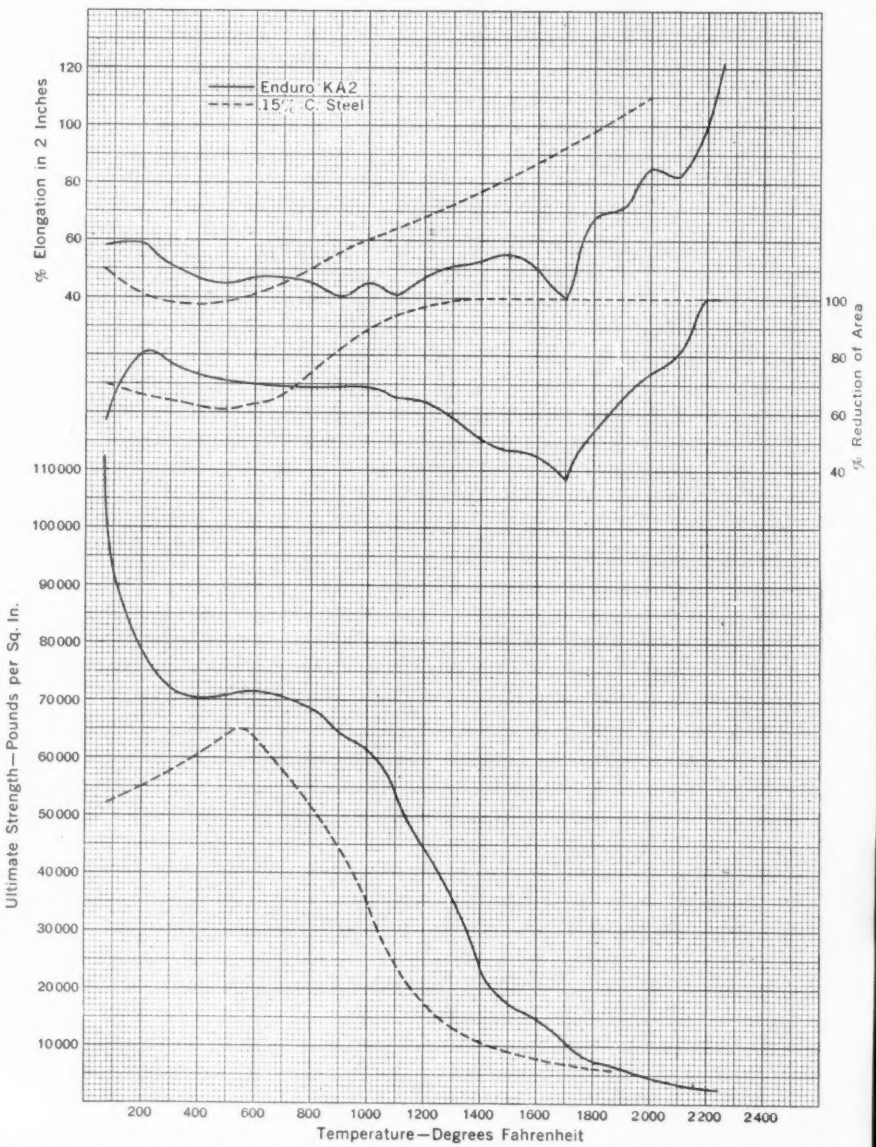

Figure 1—Effect of temperature on the physical properties of Enduro KA2 based on short time tests, compared with 0.15 per cent carbon steel

*Metallurgist, Central Alloy Steel Corp.
**Metallurgist, Babcock & Wilcox Tube Co.

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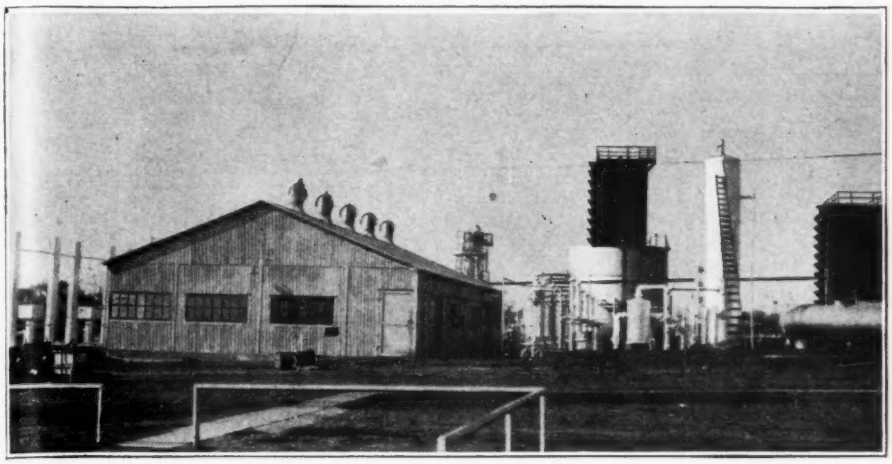

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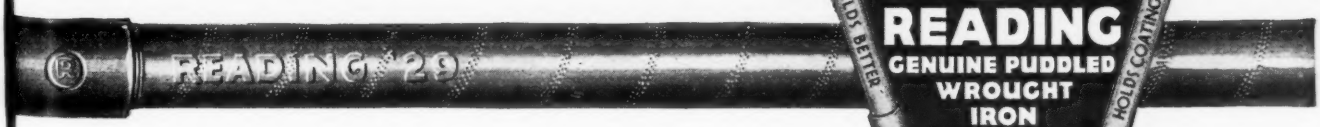

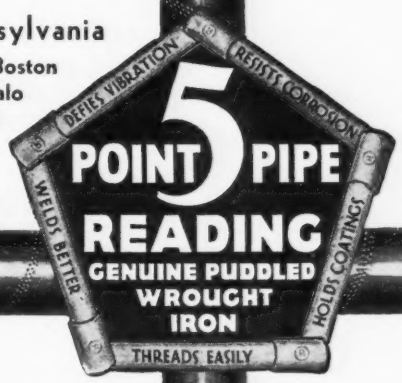

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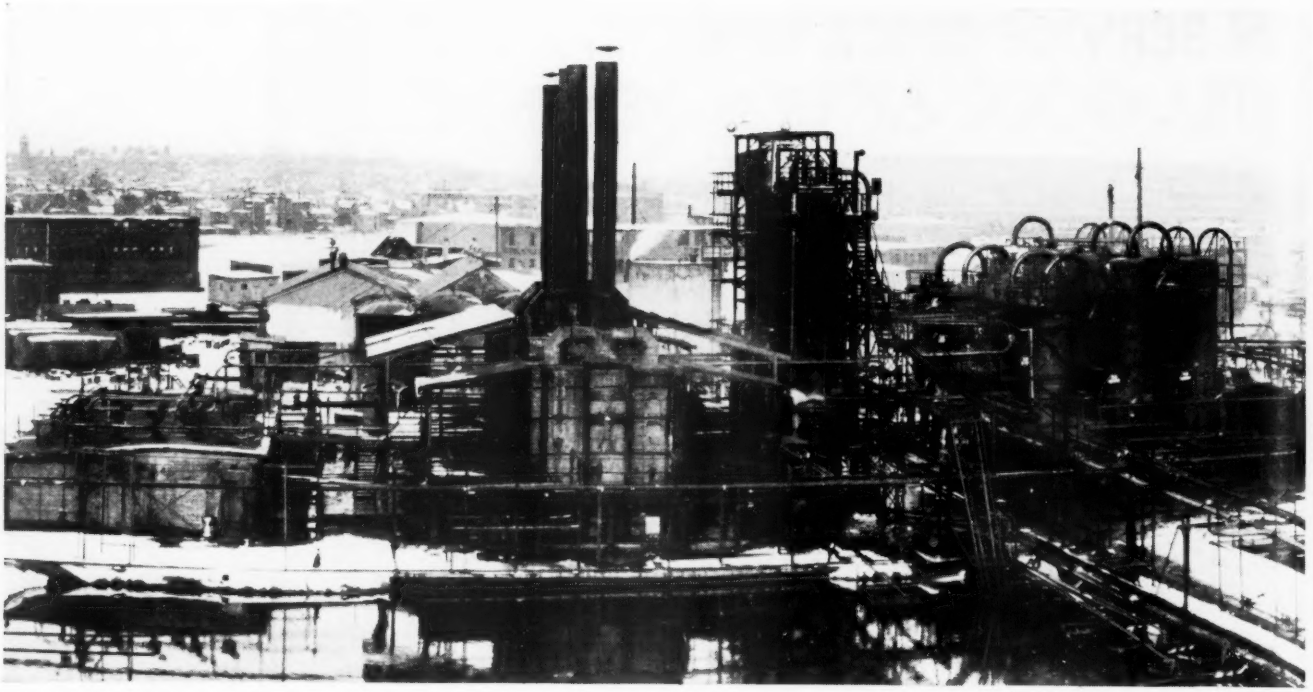


Plant of the Beacon Oil Co. In the center is a battery of high pressure cracking coils in which the use of alloy tubes is becoming more general

chromium alloy containing 16½ per cent-18½ per cent chromium, 1 per cent silicon and 0.10 per cent carbon. This alloy was fabricated successfully into seamless tubing and appeared, after several months of trial, to meet the severe requirements of the service.

Shortly after the initial test period, however, the disappointing discovery was made that the metal became brittle after being held at still temperature. This embrittlement was not present at operating temperatures but appeared after the tube had cooled to somewhat below 200 degrees F. While there was therefore no danger of a tube bursting while the still was in operation, the possibility of fracture when cleaning out the coke was so great, and in fact happened with such frequency, that the use of the 16½ per cent-18½ per cent chromium type was immediately discontinued.

The chromium-nickel, or so-called "18-8" type of "stainless" was coming into general recognition about this time, (1927-28). This alloy analyzed 16.5 per cent-19.5 per cent chromium, 7 per cent-10 per cent nickel, 0.75 per cent maximum silicon and carbon under 0.15 per cent. Due to the correct combination of chromium and nickel this alloy is non-magnetic, as is true of all austenitic steels. Some of the physical properties of this material follow:

Specific gravity, 7.86 to 7.925; weight (approx. same as steel), 0.2833 lbs. per cu. in.; coefficient of linear expansion:

From 66°F. to 600° F.....	0.0000088 per 1 deg. F.
From 66°F. to 1050° F..	0.0000096 per 1 deg. F.
Specific Heat.....	0.0118
Melting point (approx.).....	2550° F.
Scaling point (Maximum for continuous service in oxidizing atmosphere)....	1700° F.

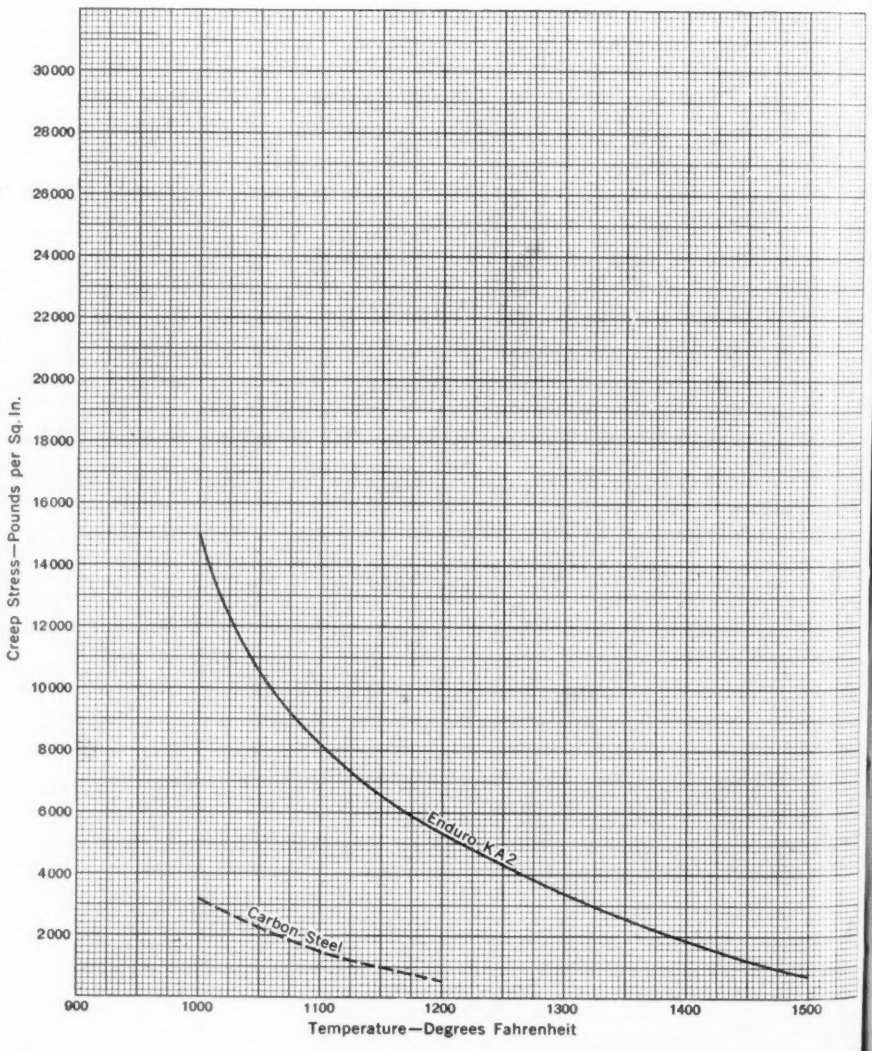


Figure 2—Creep stress. The stress which causes 1 per cent elongation in 100,000 hours at a given temperature Enduro KA2 and plain carbon steel

At the outset considerable difficulty was encountered in fabricating this alloy, but in the Enduro KA2 and KA2-S all production problems have been solved by the Krupp Nirosta licensees (Central Alloy Steel Corp. and The Babcock & Wilcox Tube Co). Tubes are now being pierced daily on a regular production schedule.

In preparing for the application of this alloy to refinery service, exhaustive tests were conducted to determine whether or not it developed a brittle condition as had the straight 16½ per cent-18½ per cent chromium iron. The investigation failed to reveal any embrittling effect occasioned by still temperatures. Charpy impact tests at elevated temperatures and at room temperature disclosed even higher results than had been anticipated.

As a result of the data thus obtained, several oil companies placed Enduro KA2 tubes in service in test installations with results so gratifying that they were immediately adopted. In a surprisingly short period of time their use has become quite general throughout the industry.

The increased life obtained from Enduro KA2 tubes brings up several related problems. Plain steel header boxes, for example, no longer offer comparable service. The necessity for removing worn out return bends from tubes which are still good for many hours of service naturally suggests the wisdom of non-corrosive return bends.

Cast headers of Enduro KA2 with tubes of the same material remove the weak factor from the assembly. Another important consideration makes advisable the use of a single material throughout. If Enduro KA2 tubes are rolled into plain steel boxes trouble may arise due to the difference in the coefficients of expansion of the two materials involved.

THE two outstanding properties which have made the high-chromium high-nickel alloy so suitable for the work in hand are its satisfactory resistance to corrosion and oxidation and its high strength and resistance to impact at elevated temperature. Figure 1 shows Enduro KA2 compared to carbon steel for short time high temperature tensile tests.

Figure 2 shows the creep stresses of the same steels, as given in Prof. F. H. Norton's book, "Creep of Steel at High Temperatures," published by the McGraw-Hill Co. The short time tests are, of course, of no real value for designing purposes, but merely furnish an indication of the essential difference between the two metals for this reason; if the strength of the metal at a given high temperature is determined only by the ordinary tensile test, a piece of equipment subjected to high temperature for a longer time, even under pressure using a safe fibre stress as determined by the short time tests, will progressively "creep."

This will continue until a point is reached where the metal thickness becomes so greatly reduced that the pressure can no longer be resisted and failure results. It is well to note that the reduction in thickness of the metal may be hastened by corrosion, oxidation or a combination of both.

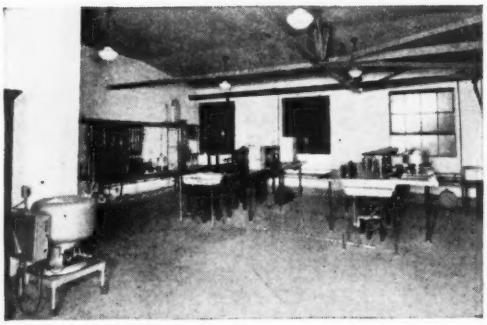
In order to design apparatus or equipment for service at elevated temperatures where stresses will be high, it is essential that the "creep strength" of the metal be determined. The creep strength at a given temperature might therefore be defined as the stress at which the metal will elongate 1 per cent during 100,000 hours at that temperature. Because of the high chromium content in combination with nickel, the creep strength of Enduro KA2 is notably higher than that of carbon steel, as shown in Figure 2.

While the greatest application of Enduro KA2 at the present time has been in cracking still tubes, refineries are also using it in salt water condensers, transfer lines and other parts of equipment showing rapid deterioration largely traceable to corrosive action alone. As with all materials having little previous use, much improvement has been made in a relatively short time. As the user becomes more familiar with the material and its performance, specifications become more rigid and tolerances more narrow, with the result that the entire standard of mill production is raised to a progressively higher plane.

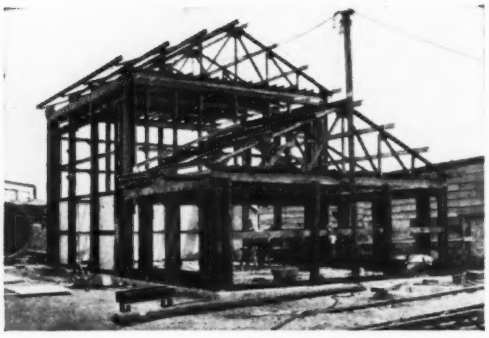
Actual service time of sufficient duration having now elapsed, it becomes evident that a material has at length been formulated to meet one of the oil industry's most serious corrosion problems.

A down the river airplane view of the Pierce Petroleum Corp. refinery at Sand Springs, Okla. In the immediate foreground is the refinery of the Chestnut & Smith Corp., which has been shut down for a number of years. In the distance and across the Arkansas river can be seen the tank farm and refinery of the Mid-Continent Petroleum Corp. in West Tulsa

COMPLE



Accurate laboratory investigation is fundamental to successful design.



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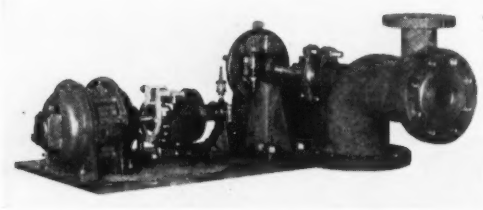

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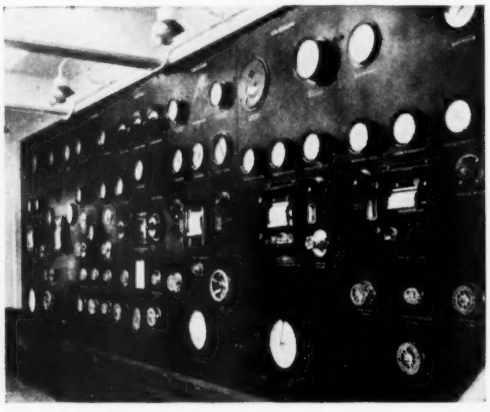

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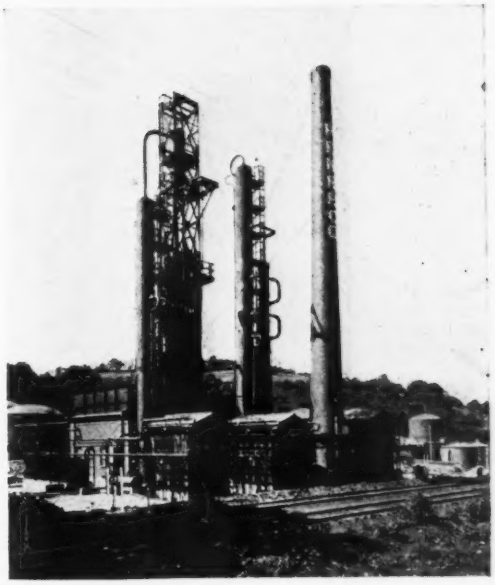
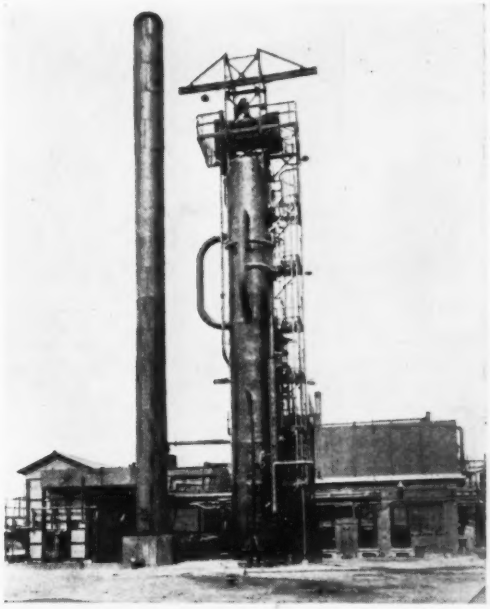


Topping, re-run and vacuum units designed and constructed for Pennsylvania Refining Company.



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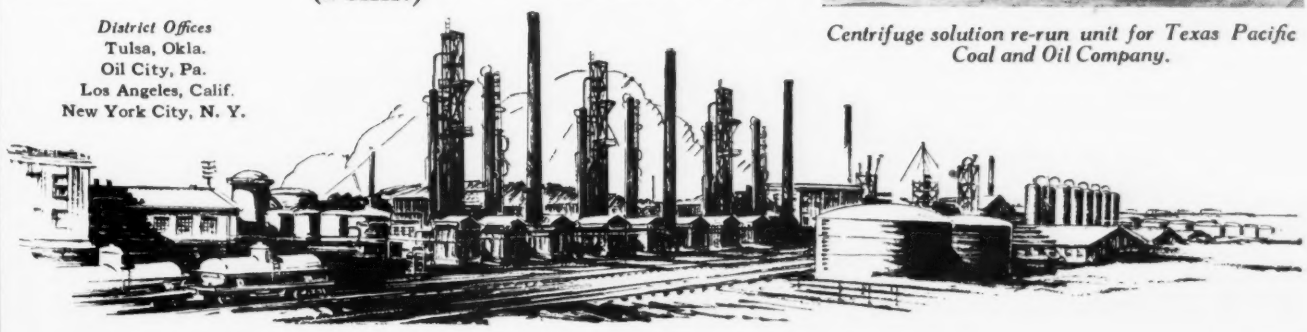

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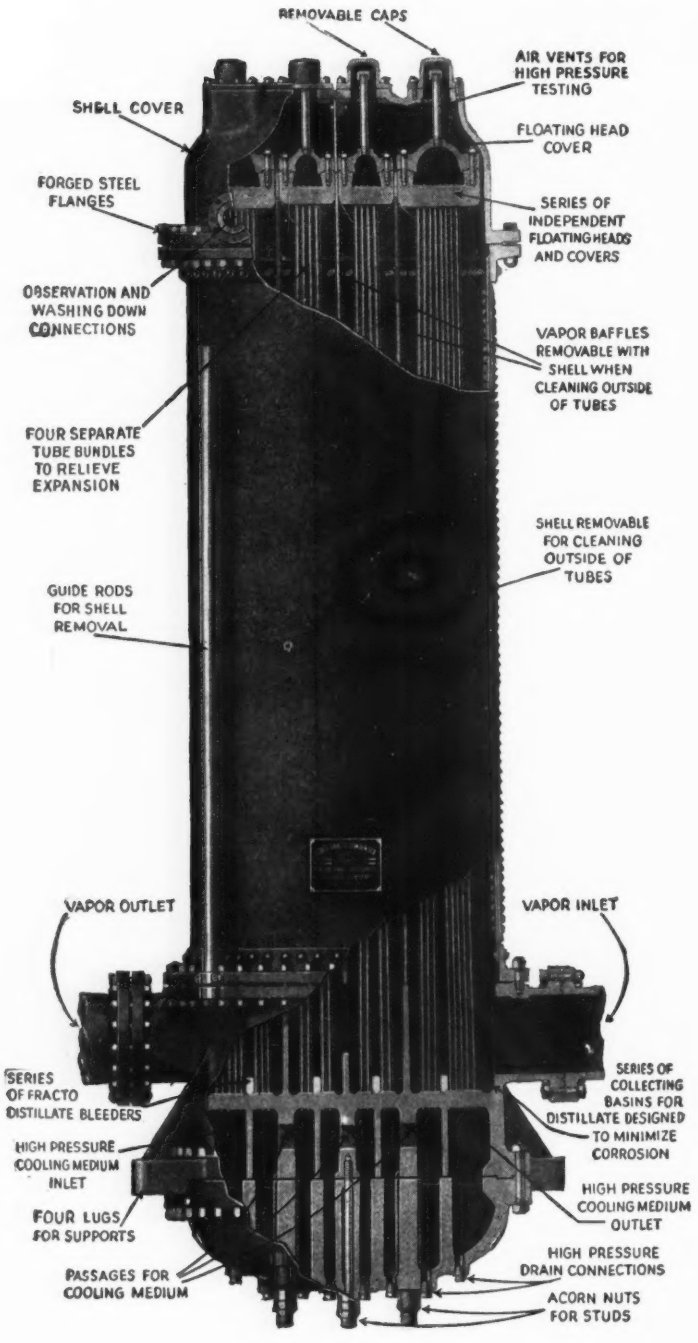
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Write for reprint of National Petroleum News Article showing application

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Notice especially:

1—The four separate tube bundles to relieve expansion.

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3—No through-bolt connecting more than two pieces. It is nearly impossible to design a three-flange joint which will remain tight under high pressures.

4—Low vapor velocities to prevent erosion.

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Fracto Control TRADE MARK REG. LEACH

New Protection System for Refineries Mixes the Foam Near the Fire

By George Blair*

ONLY one generation ago the laboratories connected with the oil industry were casting about along various lines of experimentation to find a practical means of controlling fire in flammable liquids. These efforts eventually resolved themselves into the acceptance of two basic elements; namely, aluminum-sulfate and bicarbonate of soda, which in combined solution, react to form large bubbles of carbon dioxide gas.

Given a surface tension, through the medium of a so-called "stabilizer," these bubbles were endowed with a permanence which permitted their use to blanket the burning surface of the liquid. The methods of applying were many and varied. However, the one adopted for most general use consisted of separate tanks for each solution, a steam pump, and a system of piping radiating to the various hazards.

Subsequent to the adoption of these central foam systems, the fire losses in the industry decreased at a rate such as no other industry has ever known and insurance rates followed suit. While a small reactionary element in the oil industry questions the value of foam, the proof lies in the fact that more than 90 per cent of dangerous hazards are covered at the present writing.

For the past five years the development of portable dry powder foam equipment has been progressing at a rapid rate. It is now endorsed and used by some of the largest refiners and producers. It is noteworthy that one of the largest refining companies on the Atlantic seaboard has definitely abandoned its central system in favor of portable units. It is stated that the company's reason for so doing is, first, to secure more effective fire protection and, second, to reduce maintenance costs.

This radical change in policy was decided upon after the successful handling of what might have been a very serious fire in the company's plant. On this occasion a 45-foot tank of naphtha was successfully extinguished in 9 minutes with a total expenditure of considerably less than 1 ton of foam chemicals. It is of particular interest to note that foam was applied through a hose stream, acknowledged to be the most ineffective and difficult of all methods.

This logically leads to the assumption that less chemicals and time would have been involved had the tank been fitted to permit the connection of the portable unit to the foam chambers located on the roof of the tank. This is substantiated by the subsequent extinguishing of a fire in a 93-foot tank equipped with foam chambers using slightly more than 5100 pounds of chemicals.

The first portable units designed were not looked upon as providing adequate protection, due to the fact that they were of small capacity and definitely limited in their radius of action. This was primarily due to the fact that the generators could not be used satisfactorily if the machine was located any great distance from the nozzle or other outlet.

Moreover, it was difficult to produce a quality of foam having the requisite cohesive and adhesive characteristics. On this score it has been definitely established that foam breaks down very rapidly in the presence of surface friction.

For the past several years, exhaustive research has been conducted on the subject of foam under the direction of Fisher L. Boyd, an engineer of Philadelphia. The result of this has been the duplex ejector, combining the advantages of the central or wet systems with those of the portable dry powder system and at no loss of effectiveness and desirability of either. It is of interest to note that Mr. Boyd is the fourth generation of his family who have devoted their entire efforts to fire protection engineering.

Briefly, the duplex system separately

*Vice President, National Foam System, Inc., Philadelphia.

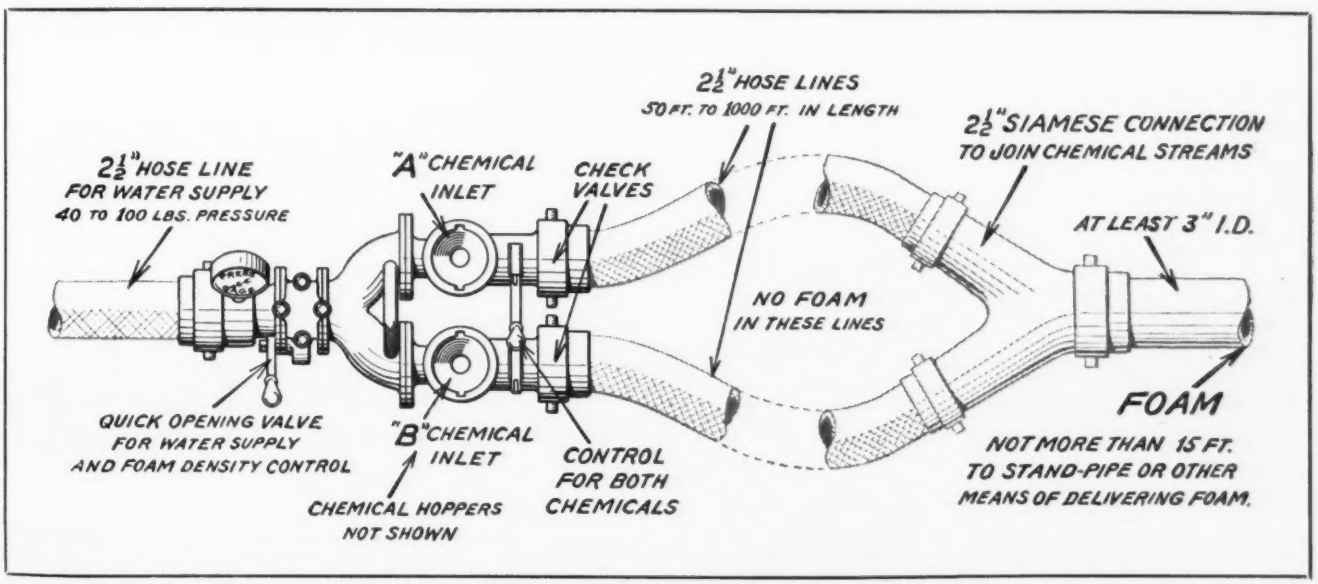


Fig. 1 Diagram of connections for duplex ejector

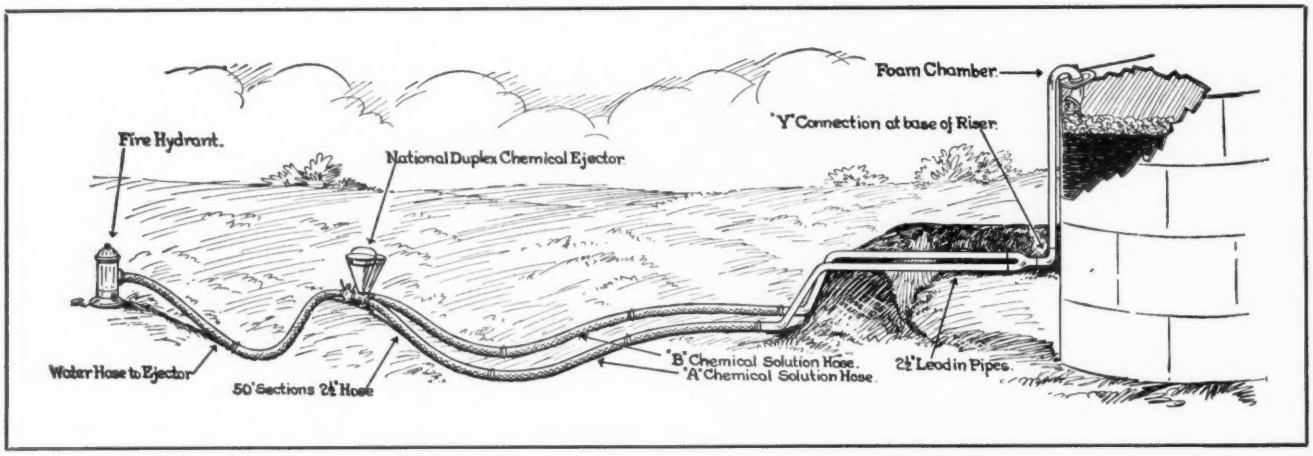


Fig. 2—Piping layout showing method of delivering foam into tank

dissolves the reacting chemicals, as indicated in the diagram shown as Fig. 1.

Solution is made at the ejector rather than foam. The radius of operation is limited only by the head losses in the lines. Installations are now in existence where foam is delivered at points in excess of 1000 feet from the ejector. The machine operates satisfactorily at water pressures varying from 40 to 120 pounds.

The trend in ejector design has developed along lines of increasing capacities to the point where portable machines are now available which will produce as much as 3000 gallons of foam per minute (400 cubic feet).

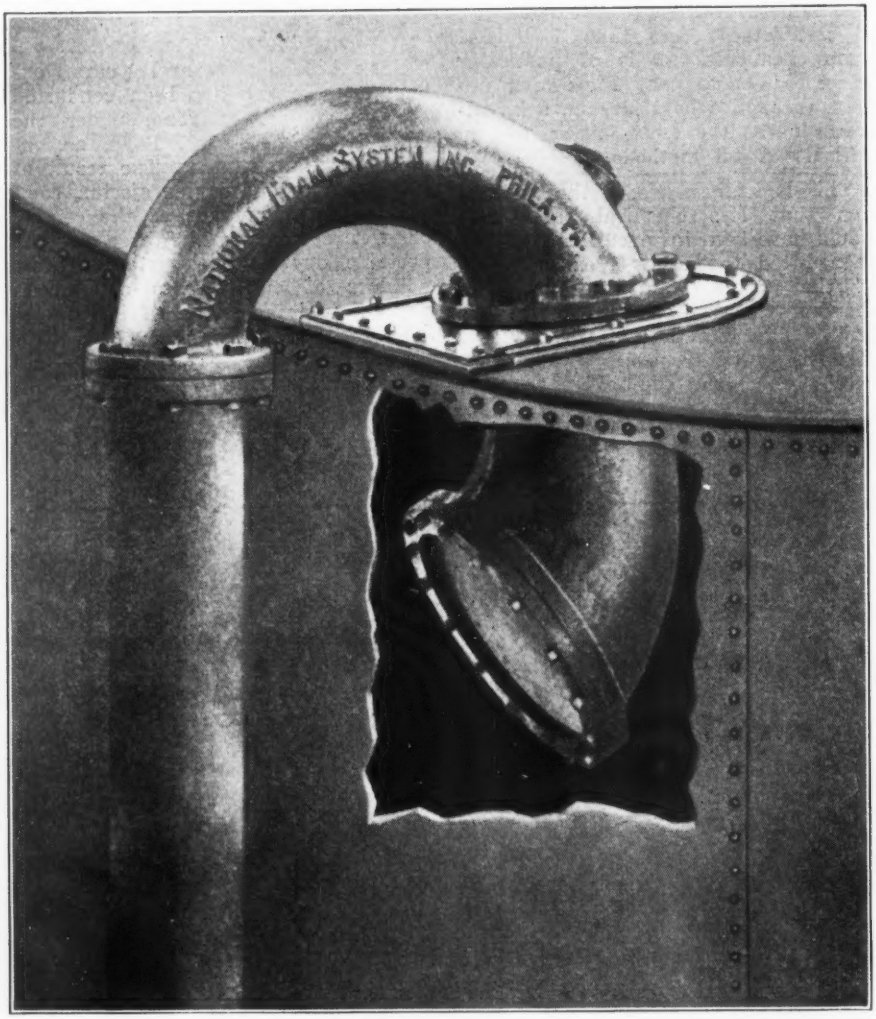


Fig. 3—Foam chamber independent of roof plates insuring freedom from leakage in case of explosion. Gasket at mouth of chamber precludes condensation in lines

Foam is most effectively applied through specially designed mixing chambers. These fittings are so arranged to preclude condensation and permit their remaining in position in case of explosion. This is accomplished through the use of a sheet metal flashing which rips out under light pressure. It is virtually a case of the dog jumping through the hoop. (See Fig. 2)

The diagram which prevents condensation is broken by the foam. The foam chambers are supplied by small solution lines, usually 2½ inch, which terminate at the fire walls or dikes. Threaded ends on these lines permit the attachment of solution hose from the ejector. (See Fig. 3.)

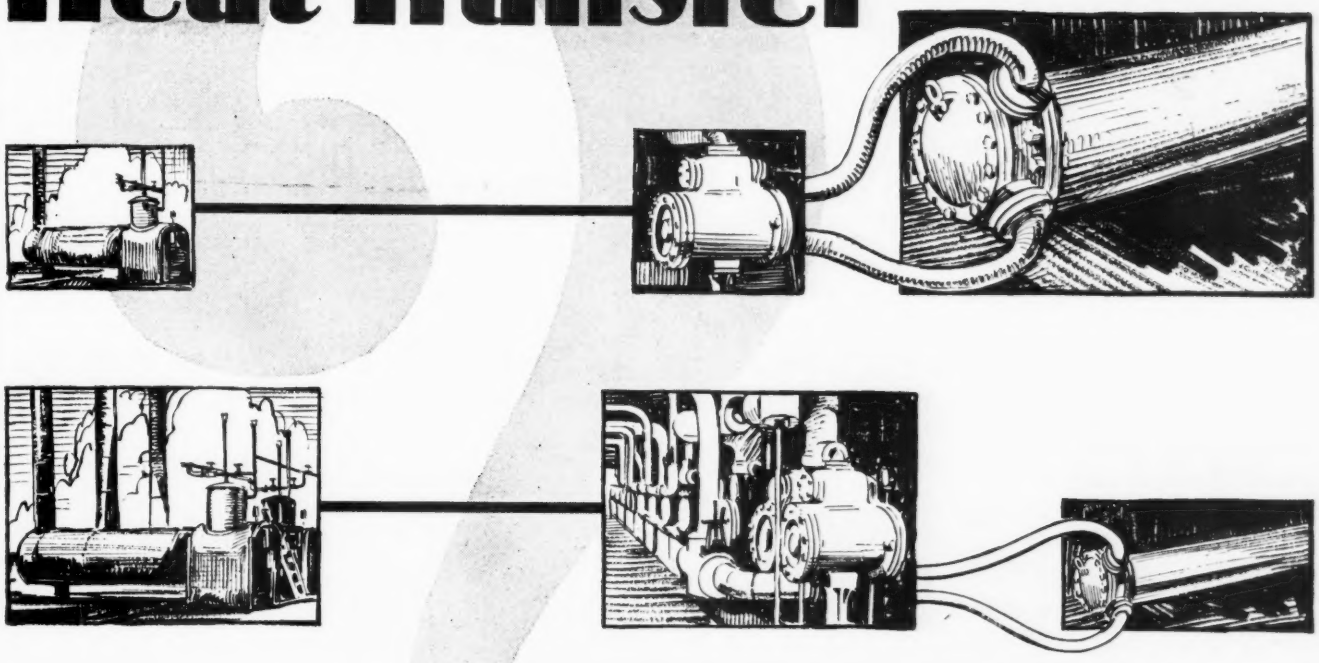
While many concerns spot ejectors and supplies of chemicals at strategic points through their plants, some prefer to employ a truck or trailer. These trailers are built to carry as much as 10,000 pounds of powder, 4 ejectors, and 2000 feet of hose. Where road conditions are favorable, this plan seems to be the most practicable.

Where roads are bad or not available at all, a number of small units, referred to above, appear more practicable. The investment required for portable equipment, for even the largest plants, is relatively small. Hermetically sealed containers for chemicals provide against deterioration regardless of climatic conditions. Units weigh 40 pounds each to permit easy handling in the field.

The amount of powder kept on hand varies in accordance with the individual plant. However, in general, a quantity of chemicals equal to two pounds for every square foot of the two largest hazards involved is sufficient to provide for any condition which may arise. In the instance of great congestion, more chemicals would naturally have to be stored.

Dry powder equipment, centrally located, with solution lines radiating to various hazards is coming into general use for bulk stations and in plants where man-power is not al-

What Price Heat Transfer



IN HEAT exchangers the transfer of heat varies almost directly with the oil velocity. The required heating surface for a given exchanger problem, therefore, is a function of the velocity of the oil. The actual cost of obtaining this velocity in pumping the oil through an exchanger varies with the efficiency of the steam generating and pumping equipment.

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ways available for handling strictly portable, hand-fed equipment. In this instance, provision is made for mechanically feeding the chemicals from large containers located on monorails. Any number of these containers may be employed depending on the amount of chemicals stored and the whole system can be operated by one man. The cost of maintenance is very low as the system is dry at all times. A typical installation is shown by diagram in Fig. 4.

Through the use of special mixing tubes and nozzles, foam may be projected, when necessary, by hose stream from 125 to 150 feet. As previously stated, the hose stream method is not recommended as the most effective means of introducing foam, however, situations arise which leave no alternative.

Along with the development of dry powder machines have come many accessories, such as: Portable foam towers and fire shields. The former is employed on tanks which have not been piped or equipped with foam chambers. The shield is a valuable part of the equipment of any plant as it permits close approach to fires and the application of both foam and water streams at effective ranges. It also makes possible approach to valves, etc., otherwise unreachable due to heat and flame.

Experiments are now being conducted to determine the feasibility of providing automatic foam protection. While the progress is satisfactory, it is not felt that any of the various devices employed are sufficiently developed to offer the oil industry.

Foam protection for marine work is rapidly coming into general use as applied to tank steamships and particularly motorships. The general practice is to carry ejector and chemicals on the bridge or other commanding situation, which will permit the introduction of foam by hose stream or deluge set to any of the cargo hatches. Permanent piping is usually provided for introducing foam into the fire room and bilges.

Considerable experimentation is now going on in the matter of the method of applying foam. There appears to be a wide diversity of opinion as to the relative merits of swing-pipes, mixing chambers, foam chutes, foam ladders, etc., etc. All these methods seem to have their own particular advantages and the question, therefore, resolves itself to one of economy and individual preference. Any method which will provide for the stability of the inlet in case of explosion and which will introduce foam to the side of a tank should prove adequate and effective.

This, of course, presupposes that the volume of foam delivered is sufficiently large to take care of the particular condition. Volume, above all, is the one essential and it can be reasonably anticipated that light and portable equipment will be available in the not far distant future, which is capable of delivering almost unbelievable quantities of foam.

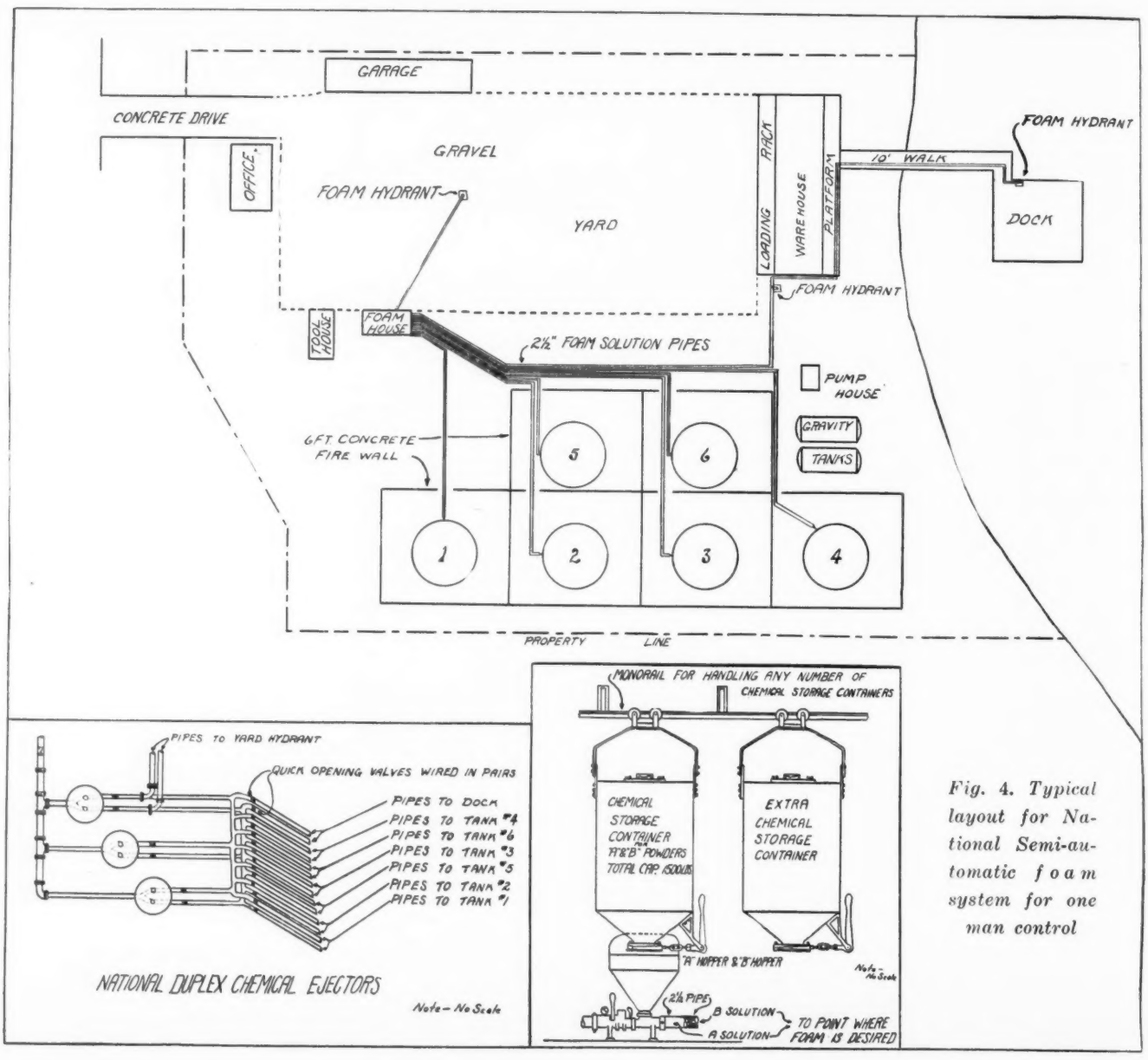


Fig. 4. Typical layout for National Semi-automatic foam system for one man control

Fig. 5. Where fire occurred July 1, 1929, in Atlantic Refining Co.'s Point Breeze plant. A 45-foot tank of naphtha caught fire and was extinguished in 9 minutes

There is one maxim to ever bear in mind in using foam; namely, the lowest velocity of introduction is the most effective velocity. As an example; it may be possible to approach close enough to a hazard to use a hose with full opening or a nozzle with a 2-inch opening or larger. This is vastly preferable to standing off 100 or 150 feet with a nozzle of 1¾-inch opening. This all works back to the irrefutable premise that the less surface friction present, the more effective the foam and greater volume delivered.

The time has passed when recommendations, as regards foam equipment, are left to guess and conjecture. The problem has been reduced to definite formulae and there are today available engineers, who make this their sole interest. This service is saving the oil industry thousands of dollars and at the same time reducing fire hazards to a point where they are comparable with those in any other field.

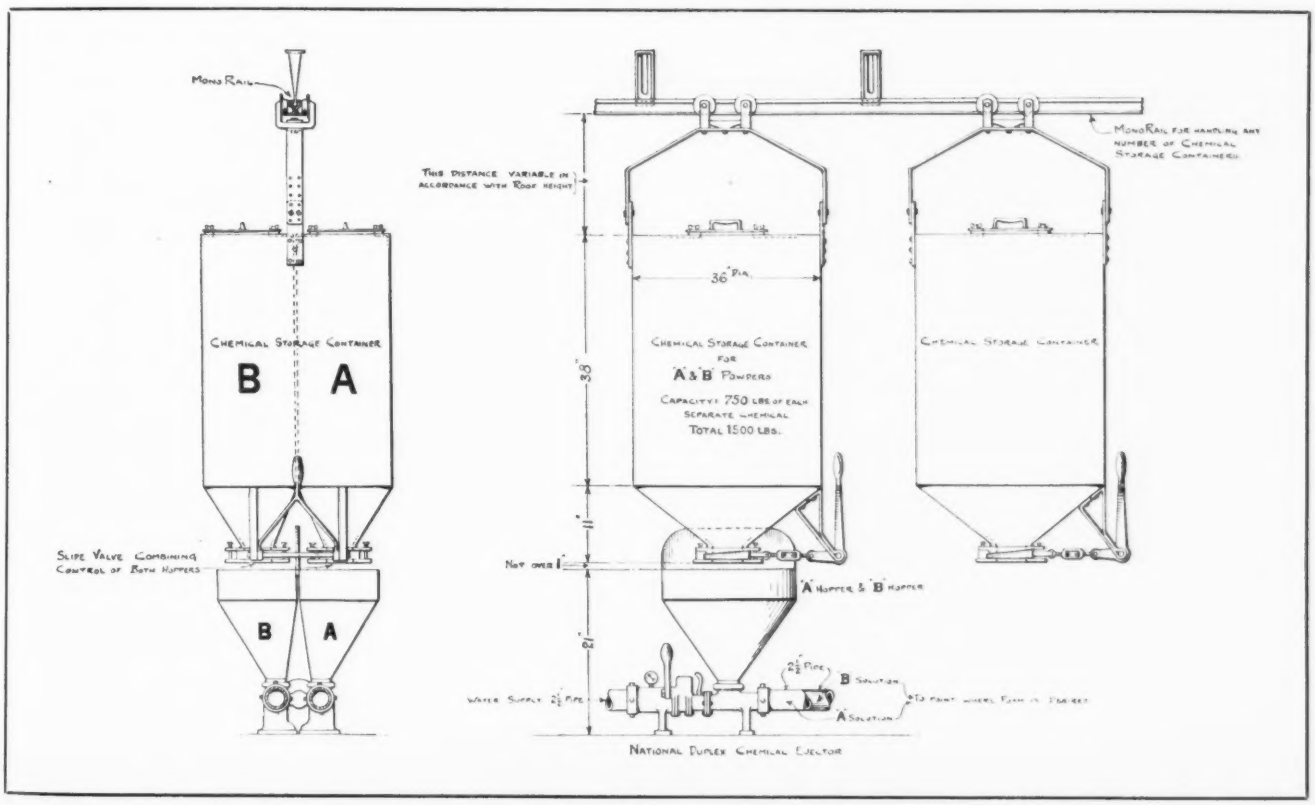


Fig. 6. Plan for continuous operation of National duplex chemical ejector

Foam Firefighting System for Protection Of Modern Plant Is Described

Contributed by the American-LaFrance and Foamite Corp.

THE generator system is a chemical fire extinguishing installation that has for its principle the application, to a fire, of a closely knit blanket of fire smothering foam, consisting of a mass of durable, minute bubbles, each bubble inflated with carbon dioxide gas which is in itself a non-supporter of combustion.

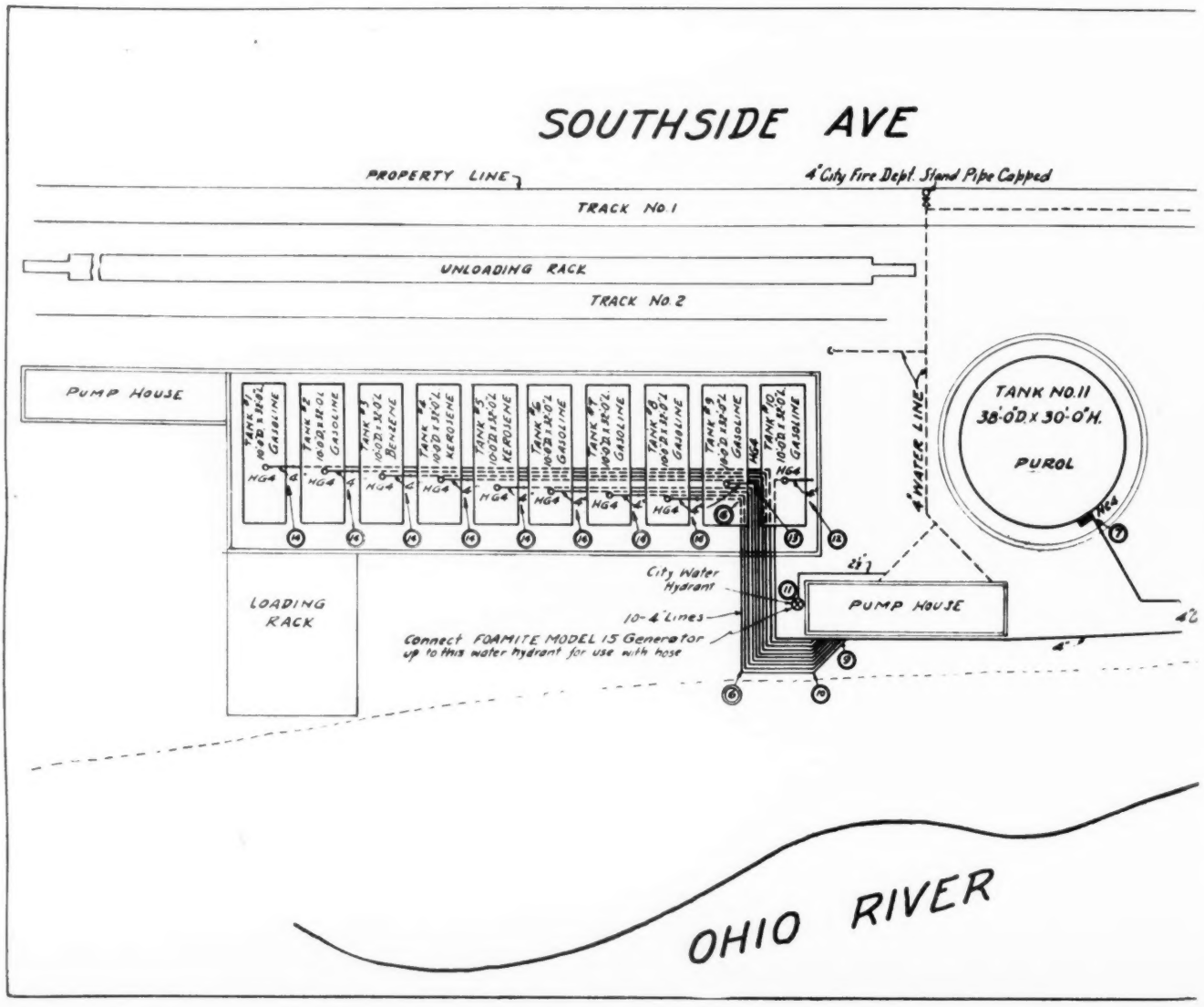
The essential components of such a system are the foam generator, foam generator powder, delivery chambers, float deflectors, delivery piping and accessories such as valves, fittings, hose, nozzles, etc.

The foam generator, literally expressed, is the heart of the system. It is a device so designed as to allow for the injection of a chemical powder into a moving water stream.

If a moving column of water has its cross-sectional area restricted, the velocity of flow in the restricted section is materially increased. If this smaller diameter column of water at high velocity is then discharged into a tube of larger diameter, the rapid expansion in the larger area creates a suction. If then, a connection is made to the atmosphere at a point between the restricted section and the section of larger diameter, the suction created will draw air into the moving column of water.

This is the underlying principle upon which the foam generator operates. Water passing through the restricted orifice section expands into the larger passage thereby creating a suction that draws powder into the water column from the hopper through the chemical inlet. This powder is carried along by the water through the discharge piping where a chemical reaction takes place and the foam is generated.

The foam generator powder is a chemically balanced mixture of several



ingredients which, in the presence of water, react and generate foam.

When used in connection with the small portable type generators, foam generator powder is packed in moisture proof sealed cans, having a capacity of about 45 pounds.

For vertical oil storage tanks the foam delivery chambers are welded steel boxes rectangular in cross section and built to fit snuggly over the top angle of the tank. Provision is made for rigidly attaching the body of the chamber to the tank top angle in a manner that will withstand the explosions often incident to tank fires.

The mouth of the chamber (the outlet that delivers foam to the tank interior) is provided with a vapor proof, rupturable diaphragm designed to prevent volatile vapors from entering the chamber proper and condensing in the foam delivery piping. Handholes are provided to give access to the interior of the chamber.

For horizontal oil storage tanks, the delivery chambers take the form of a stubby cylindrical steel box, provision being made for connecting the outlet to a flange riveted to the dome of the tank. This chamber is made vapor-proof by placing a light lead cap over the inlet connection.

The Foamite float deflector is in effect a buoyant metal platform or sheet metal floating box, installed below the mouth of the delivery chamber and riding between two cable guides so as to float on the oil surface at whatever level the tank contents may happen to be. The function of the float deflector is to prevent the foam from plunging below the oil level in the event that the oil content of the tank is low at the time of fire. The submerging of foam would cause it to become oil-coated, and therefore of reduced efficiency.

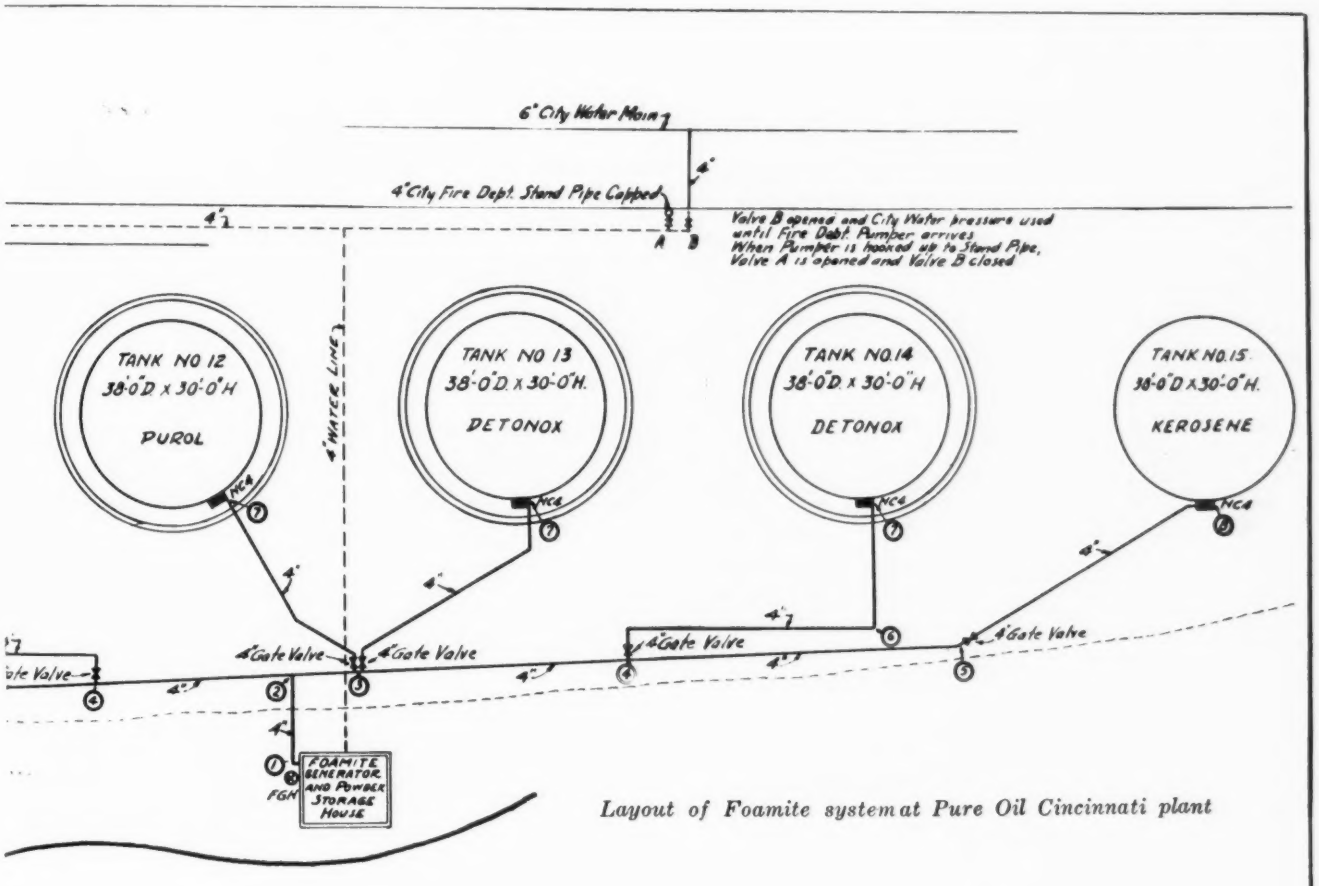
The float deflector is constructed in sections, small enough to admit of passage through a tank-roof manhole, the sections being arranged for bolting together. Being normally filled with air, each section is provided with a vent, sealed with fusible metal to prevent the interior from becoming oil-logged. Under fire conditions, of course, the vent seals would fuse and relieve the pressure due to heated air expansion.

The delivery piping is used for conveying the foam in process of generation, from the generator to the delivery chambers. The diameter and length of this delivery piping varies, depending on the capacity of the generators used.

A typical bulk station layout protected with a foam generator system is shown herewith. This station involving five vertical and 10 horizontal tanks has just recently been completed by one of the large oil companies in the middle west.

Two foam generators were purchased for this layout, one to be located in the generator house where it is connected to the fixed delivery piping leading to the tanks, and the other to be used with hose and nozzles as an auxiliary portable unit.

The generator used for hose stream application requires a water supply of 60 gallons per minute, at 100 pounds pressure at the generator inlet, consumes 90 pounds of powder per minute and delivers approximately 500 gallons of foam per minute. When used in conjunction with 150 feet 2½-inch cot-


6" City Water Main
4" City Fire Dept. Stand Pipe Capped
Valve B opened and City Water pressure used until Fire Dept. Pumper arrives. When Pumper is hooked up to Stand Pipe, Valve A is opened and Valve B closed
TANK NO 12
38'-0"D x 30'-0"H
PUROL
TANK NO 13
38'-0"D x 30'-0"H.
DETONOX
TANK NO.14
38'-0"D x 30'-0"H
DETONOX
TANK NO.15
38'-0"D x 30'-0"H.
KEROSENE
4" WATER LINE
4" Gate Valve
FOAMITE GENERATOR AND POWDER STORAGE HOUSE
FGH
LEGEND -
NC4 = FOAMITE DELIVERY CHAMBER, TYPE NC4
HG4 = FOAMITE DELIVERY CHAMBER, TYPE HG4
FGH = FOAMITE GENERATOR HYDRANT

Layout of Foamite system at Pure Oil Cincinnati plant

ton rubber lined hose and a playpipe with 1¾-inch tip, the stream range will measure 65 feet to 75 feet.

The generator located in the generator house is identical in appearance to the one used for hose stream work, the only difference being the increased size of the orifice tubes, which gives it a larger capacity. This generator requires a water supply of 120 gallons per minute at 100 pounds pressure at the inlet, consumes 200 pounds of powder per minute and delivers 1300 gallons of foam per minute.

It is connected on the inlet side through an 18-inch length of 2½-inch flexible hose to the water supply. On the outlet side, it is connected to a 4-inch piping manifold from which a series of valve-controlled 4-inch foam lines (maximum length 400 feet) lead to the tankage being protected. The control valves are located at least one tank diameter distance from the tanks, for safety in operation. Each control valve is conspicuously marked with an enamel sign having white letters on a background of red.

This generator in conjunction with 100 feet of 2½-inch cotton rubber lined hose may also be used for hose stream work, the stream range in this case measuring 100 feet to 110 feet. A hose angle valve is located just outside the generator house, to which the hose may be connected. This hose angle valve is connected through a short length of pipe to the 4-inch piping manifold above referred to.

The layout illustrated would require about 9000 pounds of foam powder. The amount of powder figured is, of course, dependent on the number of tanks involved, the size, contents, construction and relative locations with respect to one another. Provision is made for storing the powder in the generator house.

In case of fire, the hopper should be filled immediately with the foam powder from the cans and the water supply valve opened. The control valve (normally closed) which is located in the pipe leading to the tank on fire should be opened to allow the foam to be directed to this particular tank. The foam is carried to the delivery chamber with sufficient pressure to rupture the vapor proof diaphragm, allowing the foam to be applied to the surface of the burning liquid. All that remains to be done is to keep feeding the powder to the generator until sufficient foam is delivered to completely seal off the oil surface with a blanket of foam.

Skilled Men and Control Instruments Spell Boiler House Efficiency

By Edwards R. Fish

MAJOR developments in boiler practice come about comparatively slowly so that the noticeable changes from year to year are not usually very great. Any such must necessarily withstand the test of time and demonstrate that continued economical and dependable service may be expected before being generally adopted.

The large power houses of the public utilities are where most of the outstanding and epoch making experiments have been tried. Of the failures, little is heard but the successes are quickly adopted, not only by other plants of the same character but by the multitudinous industries as well.

To the pioneers in the improvement of power plant practice should be accorded full measure of appreciation for what they have accomplished and this includes manufacturers of apparatus as well as users for all industries using steam are their debtors. Among these latter is the oil industry which however has not, generally speaking, profited to as great an extent as it should.

In the Oct. 24, 1928, issue of the NATIONAL PETROLEUM NEWS there appeared an excellent article on "Boilers for the Oil Refinery," all of which is as pertinent today as it was then, so no attempt will be made to repeat what is therein contained.

The factors governing the design of a boiler plant for an oil refinery are not any different in the essentials than those applying to any other industry requiring steam. In no two instances are the conditions that should be considered in arriving at a decision exactly the same, even in the same location. Any specific illustration of a concrete case, therefore, is of little value so none such will be attempted. Suffice it to say that an intelligent layout can be made only by one who is thoroughly versed in the arts of conserving heat and equating the anticipated results with the estimated expenditure.

For the purpose of the discussion, all the appurtenances immediately connected with the boiler will be included, —fuel burning apparatus, water walls and setting, superheater, economizer, air heater, flue, chimney or other draft producing equipment, and measuring and indicating instruments.

The rational design of the steam plant involves a complete heat balance as one of the first steps; i.e., the accounting for of all of the heat liberated in the furnace. The largest portion of this heat is that contained in the steam leaving the boiler room. If accurate data of steam consumption for the various purposes are not available, as close an estimate as possible of the probable requirements must be made, and also of the variation in demand over the 24-hour period.

To what extent economizers and air heaters are justified must be determined by conditions, but it is an exceptional plant in which superheaters can be omitted. When the higher steam pressures are used feed water can be heated by bleeding from an intermediate stage of the turbine.

Indeed, process steam for almost any purpose may be advantageously obtained in this way and at the temperature best suited for the result sought. The kind and cost of fuel will influence the design of furnace and fuel burning equipment. If

EDWARDS R. FISH is a graduate of Washington University, St. Louis, Mo., in mechanical engineering in 1892. He entered the employ of the Heine Boiler Co. in 1893 and has since always been connected with that company. He was at various times in responsible positions in practically every phase of the business, becoming secertary in 1897 and vice-president in 1919. He is a member of the A. S. M. E. Boiler Code Committee, the Power Test Code Committee and served three years as a manager of the society and two years as a vice-president. Since the acquisition of the Heine company by Combustion Engineering Corp., he has been in the boiler engineering department and is now consulting engineer to that department.

pulverized coal is indicated, water cooled walls will almost inevitably be needed, but whether the pulverizing equipment should be a central grinding plant with storage or of the unit pulverizer type is dependent on the analysis of the governing factors. If stokers seem preferable, the choice of type depends on the character of the coal and rate of operation.

Old fashioned hand firing is not permissible in any but the most insignificant of plants and even for such, automatic or semi-automatic stokers are available. Furnace volume and shape must be studied and designed to coordinate with the fuel burning equipment and in this do not err by being stingy. Better more volume than is needed than not enough.

The temperatures of waste gases from the various distilling and refining processes are usually sufficiently high, say 900 F. or over, to make it advantageous to utilize them as a source of heat for making steam. The monetary loss due to the non-use of such gases is now generally recognized and heat recovery is often effected by other means. There are many plants, however, where the use of such gases in steam boilers is the preferable expedient. But by all means, in some way utilize to the greatest possible degree the fuel value of high temperature gases from whatever source.

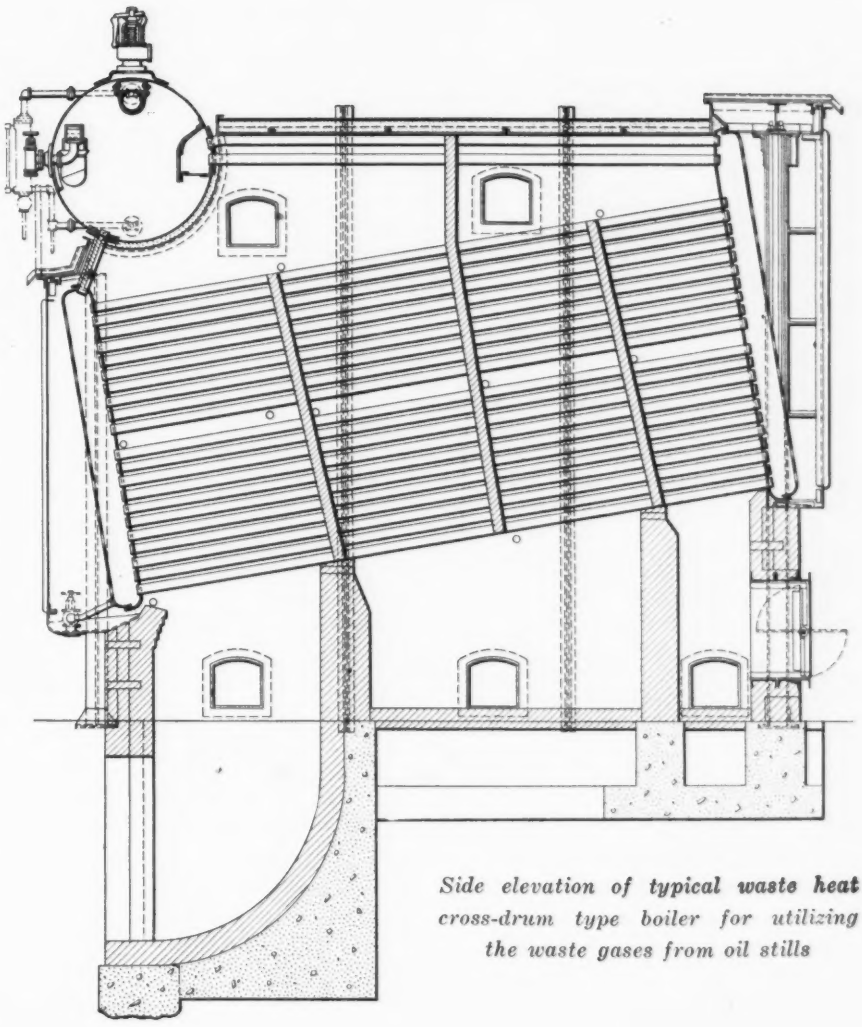
The development of the steam turbine has been the principal cause of the demand for high steam pressures and temperatures and such prime movers are now very generally used for power production. These high figures are justified by the resulting economies in operation. What is the most economical pressure and temperature to use must be determined for each case.

In general for refinery use, an upper limit of 600 pounds per square inch and a temperature of 750 F. may be set.

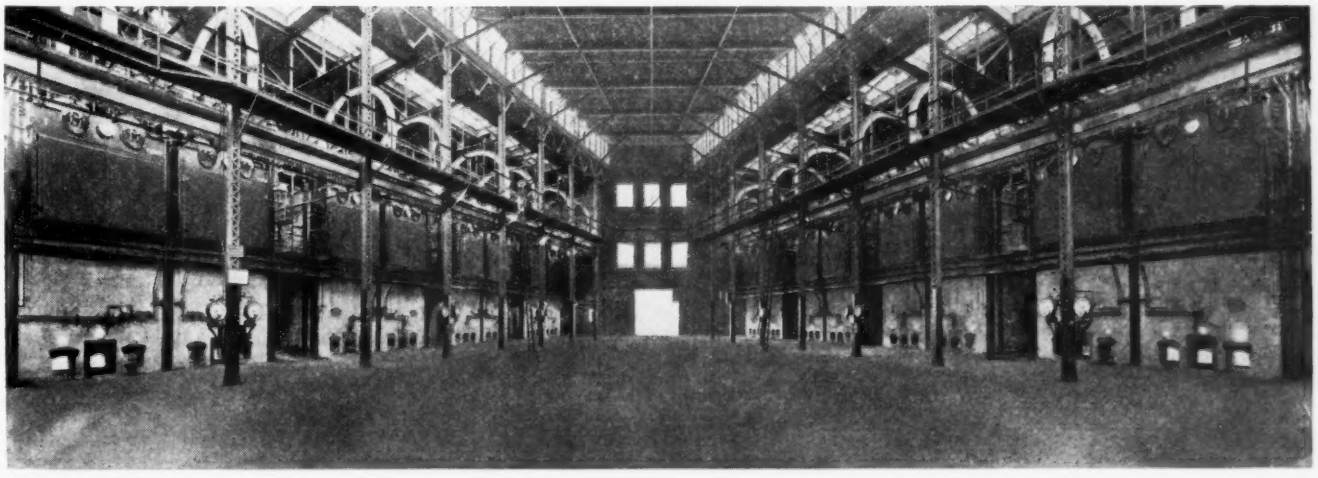
To go higher than these figures incurs complications of design, such as interstage reheating, that will probably not be justified at the present stage of development. There is one industry outside of the large power stations that is installing an 1800-pound plant, the outcome of which will, no doubt, determine whether a more general use of pressures of this order of magnitude will be warranted.

Refinery operators have become accustomed to high pressures and temperatures in the refining processes so that they should not hesitate to adopt corresponding characteristics in the steam plant.

Faced with the demand for higher steam pressures, boiler manufacturers have had to change methods of fabrication and type of shop equipment so that there is now no difficulty in obtaining boilers for any pressure whatsoever, at an increase in cost over the lower pressures that is not at all proportional to the increase in pressure. Corresponding development in auxili-



Side elevation of typical waste heat cross-drum type boiler for utilizing the waste gases from oil stills

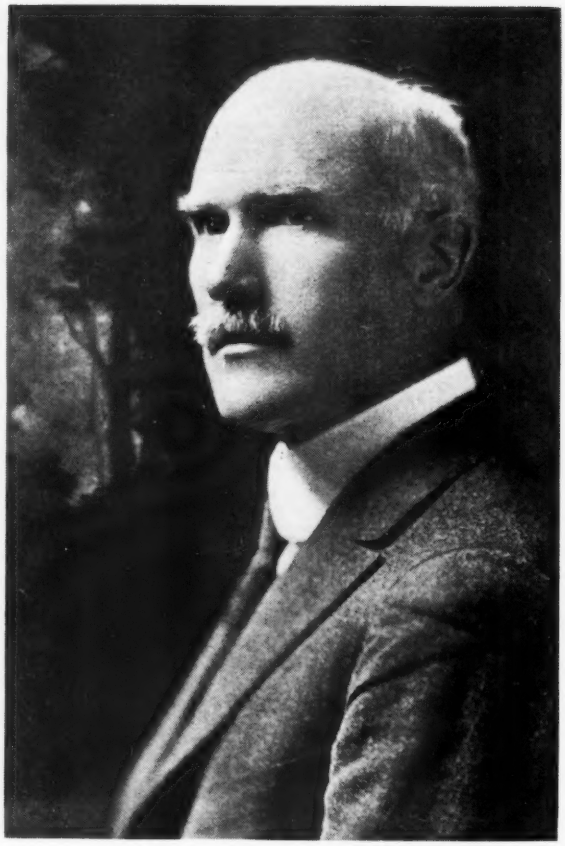


View of a boiler room in a large eastern oil refinery. The boilers are of the box-header type and are oil fired

ary apparatus of every kind has kept pace, in consequence of which every item needed for the completion of even a highly complicated installation is readily obtainable.

Control systems that largely eliminate the personal factor in the operation of boilers are now available. These automatically adjust the furnace conditions to the steam demand, thus maintaining at all times the maximum possible economical conditions. Here again it is the designing engineers' job to determine whether some such system is or is not justifiable.

In order to know definitely what the boiler plant is doing and to assure the continued maintenance of the standard of operation, sufficient indicating and recording instruments must be provided of which steam flow meters, CO_2 apparatus, draft gauges and pyrometers, in addition to the usual steam and water gauges are typical examples. No boiler room should lack any of those mentioned and it is highly important all such should be properly cared for and kept in accurately operating condition.



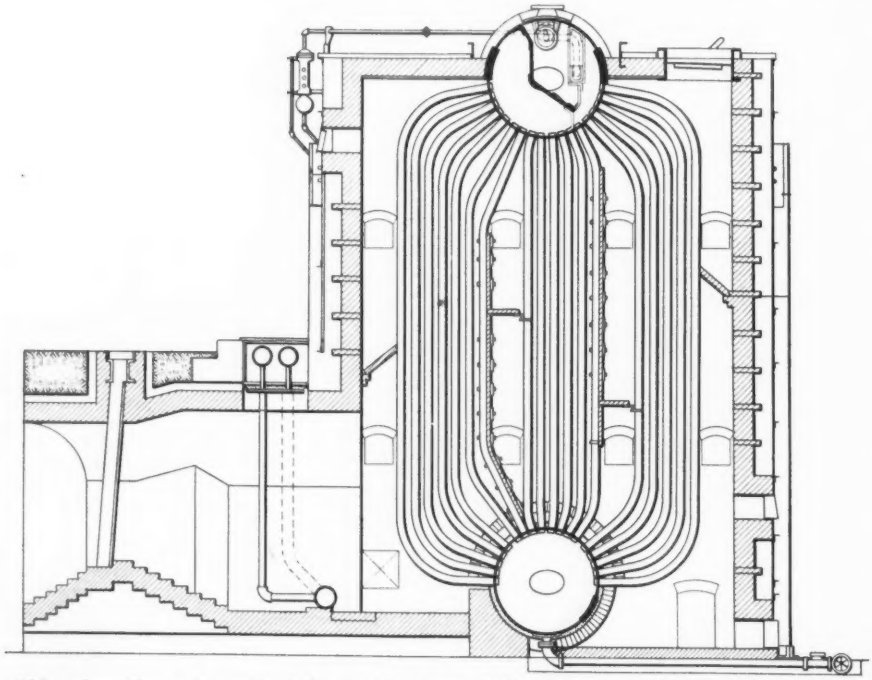
Edwards R. Fish

Better have none at all than to be lulled into a sense of complacent satisfaction by erroneous information that must eventually be the downfall of one or more of those responsible for the prevention of wasteful operation.

An up-to-date boiler plant in an oil refinery as elsewhere requires a much higher type of attendance than formerly. Such men are readily obtainable, the smaller plants drawing very frequently on the larger ones where young technicians have gotten a fine training. Such supervision will unquestionably far more than return its cost. A detailed study and careful analysis of almost any existing plant, if it has not been kept abreast the times, will reveal astonishing possibilities of savings that may be effected at a surprisingly small outlay. But such an investigation should preferably be made by a trained engineer who has not been connected with the plant and who sees the various problems from a different and unbiased viewpoint. This plan should not be taken by the plant engineers as a reflection on their ability.

Unless a separate department for the express purpose is maintained, it is not possible for the regular staff to adequately handle such problems. The reasonableness of this idea is quite generally recognized and very frequently adopted.

The foregoing is only a brief discussion of the high lights of the steam generating problem and is intended to call to the attention of those concerned the many factors that must be considered in connection with modern power plant practice and the means by which to solve them.



Side elevation of vertical bent-tube type boiler designed for utilizing waste gases

Repairs Valves With Manganese Bronze

NEW YORK, Oct. 25.—Worn rotary valves on oil pumping equipment have been successfully built up with manganese bronze applied with a welding blowpipe by a western oil company, according to the October issue of "Oxy-Acetylene Tips," house organ of the Linde Air Products Co., 205 East 42nd St.

The valve being repaired is machined to the correct size for the redrilled bore after it has been built up with manganese bronze, costing half the price of a new valve, according to the Linde company. The oil company in question, the Linde company says, is using the oxy-acetylene process regularly now for the repair of rotary valves.

International Derrick & Equipment Co., Columbus, O., through its Boykin Greyhound division, has introduced a new 27-inch make and break rotary, claimed to have greater speed and smoother operation and roller bearings.

The new device is changed quickly from a make-up position to the break-out position by lifting the spider by the catline until the teeth are disengaged. Slides are moved out and the spider lowered so that it becomes part of the table and revolves with it. Chrome nickel steel makes up the main table, spider, table and bearing box base, pinion and sprocket.

Acetylene Welding Is Now Standardized; Details to Be Studied Further

By G. O. Carter*

THE subject of oxy-acetylene welding has been under consideration in the petroleum industry for at least 20 years. At first, welding was introduced as a "cure-all," and was tried in many places where it was not surrounded with the necessary engineering and managerial control and the results were not up to the promises.

In many places welding fell into competent hands and was utilized in practically every way that we are now so accustomed to. The satisfaction with which these pioneers used welding is one of the impressive points with regard to the utilization of the process.

From studies made of these earlier successful applications of acetylene welding, certain standards of workmanship have been developed, and a great deal has been learned about design for welding and the specification of suitable materials. This information has been so compiled that it is now available to practically every one who desires to take up welding or to specify its use.

Only a few years ago, the efforts of those interested in acetylene welding was necessarily devoted to calling attention of executives to the use of the process. The vital thing of interest at that time was the process itself as compared with the joining of metal parts by riveting, screw connections and other mechanical means. As a result of this promotional work and the unquestioned merit of the oxy-acetylene weld, it has become one standard method of joining metals.

Inasmuch as industry has universally accepted the process, those who are closely connected with it are now able to devote attention to the details of welding. Such attention is rewarded by the effecting of many real economies, and to some extent, by the improvement in specialty work.

It is now recognized in many directions that simple qualification tests can be made that insure having capable workmen. What seems like a relatively simple problem now receives a good deal of attention with regard to such details as making the test plates, the speed with which welding must be done, the method of effecting bends for ductility and for cutting out and pulling tensile tests.

When an organization puts in the time to solve such matters and when it has personnel qualified to handle them, it is obvious that the welding process is more dependable in direct proportion to the extent of the increased control and supervision. Those in executive capacity in the petroleum industry should recognize that all welding should be done under rigid supervision and specification—just exactly as other forms of fabrication have been supervised and specified.

Welding a pressure vessel

It will be found that certain metals are more suitable for joining by welding than are certain other compositions of metal. To those thoroughly experienced in the mechanical arts, it is well known that for important work where plates must be bent, such as in flanging operations, that the composition of the metal must be kept within close control, and that frequently certain rolling practices, or heat treatment must be followed.

In the same way, the tougher and more ductile compositions of metal are more suitable under the welding flame than are the higher carbon, more brittle materials. Frequently, it is important that tests be made for cleanness of steel; that is, freedom from harmful impurities.

In connection with the materials, it should, of course, be kept in mind that welding rods are very important as they control the quality of the weld metal. No one would think of using hard alloy steel for making rivets, which must be very ductile to withstand the forging operation. Nor would one think of using rivet material for making the bolts for connecting flanges on high temperature lines where it is well known that high strength alloy steel materials are almost essential. Neither should one use an ordinary piece of steel wire for making a weld.

There are certain compositions of welding rod that give dependable results for the conditions desired. The American Welding Society has issued many specifications for welding rods which are most intended for making welds in low strength steel.

Then, there are certain classes of rods that will give increased strength to the extent of from 20 to 50 per cent above the strength of Norway iron, depending upon the rod and the ability to heat treat the finished work. For bronze welding, which is an application that is increasing rapidly for joining of steel and cast iron, one may obtain special high strength rods that will not give off appreciable quantities of objectionable fumes.

From this it can be seen that there are still further details to consider beside qualifying and checking the ability of the men. To carry this line of thought one more step,—consider how welding costs have changed on the basis of the preparation of material so as to make a suitable joint. One of the outstanding benefits of the oxy-acetylene welding process is that the most suitable joint is the butt weld, preferably made from two sides when accessible, or from one side of pipe and such shapes.

The use of the butt weld means that the preparation is the simplest that can be devised, usually involving a trimming operation to bring the material to dimension and a bevelling operation to permit access to the bottom of the joint. With other methods of fabrication, and particularly with other welding processes, considerable work is called for to provide for overlapping joints. In pipe, this involves operations for belling and shaping. The use of any overlapping joint also requires additional metal.

*Consulting engineer, The Linde Air Products Co.

Pipe Line Welding

The question as to which type of joint is to be used sometimes resolves itself into the belief that overlapping joints are more dependable than the butt joints. This is not the case, as has been proven by almost countless tests. If managers would spend on inspection a small amount of the money to be saved by the use of the butt joint over other joints, the results would be completely satisfactory. As a matter of fact, the present results are such that defects in well-made butt welds are almost unheard of.

The uses of oxy-acetylene welding in the petroleum industry cover practically every type of production and every composition of metal. The highest grades of equipment are probably the pressure vessels and the high pressure pipe lines. There are hundreds, if not thousands, of such vessels in use today giving the utmost satisfaction. The amount of work done in acetylene welding of pipe lines is well known, but we are prone to lose sight of the pipe work that is done within refineries. In many places, structures such as towers, bridges and other buildings are being built with the welding torch.

Repairs of cast iron and cast steel machinery parts are a regular operation in practically all plants. There is nothing too large nor too complicated to be welded successfully, although sometimes it is desirable to call in skilled men for advice on difficult problems.

Due to the multiplicity of welding operations which involve real savings, both in original construction and plant equipment and maintenance thereon, it is most essential for plant operating men to be "welding minded." Of course, executives cannot follow all the jobs, but through knowing that there is a handsome reward for successful welding, they are today building up welding departments under experienced engineers and operators.

It seems certain that during the next few years, much more attention will be paid to the quality of work, the use of high grade filler materials and specifications of the best mechanical design for welding.

The administration and execution of any welding job may be handled under a method that has been in use for some years, designated procedure control. The development of this method was the result of the study of several large and intricate welding problems. In undertaking to specify what should be done in such work, it was appreciated that the subject of welding could be sub-divided into logical divisions, permitting each distinct phase of welding to be properly controlled by those interested in using the process. No change has been made in this division of the subject into six heads after its use for five or six years, which indicates that the original "break-down" was adequate.

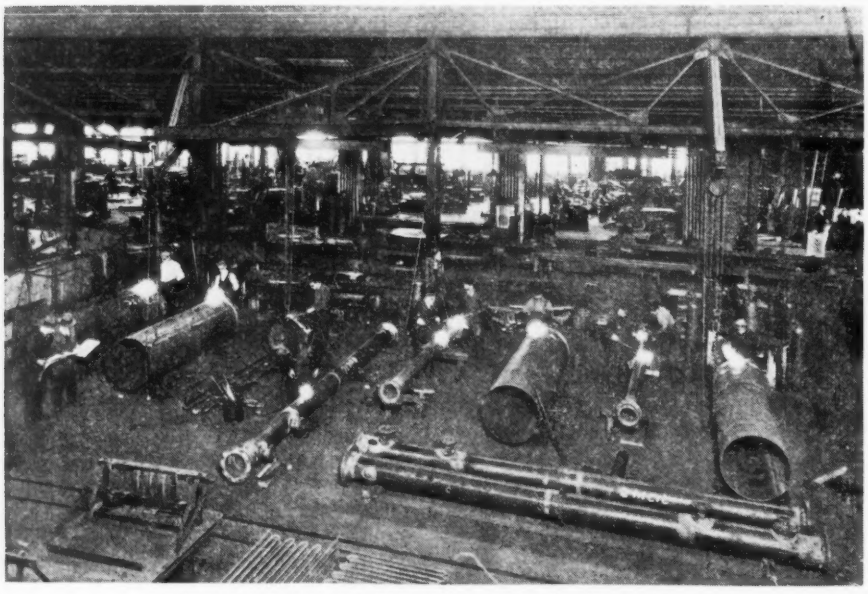
The six major divisions are: Qualification of welders; control of quality of materials to be used; correct designing of joint; correct preparation of material for welding; following satisfactory ways of carrying through the operation when once started, and, finally, the application of a suitable test. These major divisions of welding cover any welding problem because they should be followed, irrespective of the materials to be used or the type of construction desired. Procedure control is just as applicable to the welding of aluminum, or cast iron, or steel, and it is just as applicable to structural welding as to pressure vessel welding, or pipe welding, or the making of repairs.

When any given welding job is under consideration, an executive can analyze it to determine what factors are known and what are unknown or experimental, so that he can eliminate all but the things that must be proved. In most cases, all factors are known because of the very careful study that has been made of oxy-acetylene welding as applied to various metals and various types of construction.

Certainly, it is easy to specify what qualification test will be suitable to assure of good workmanship for the given job. It is also easy to specify the grade of base metal and the grade of welding rod unless the work must be done with a new composition, in which case there may be required some experimentation with the welding rod or with the preparation of the job and the welding practice. So much has been done in experimenting with various compositions of base metal that even this can be put on a sound engineering basis in almost all cases today.

The design of joint can be specified and will usually be noted on blue prints of the job. As the butt joint is so suitable for oxy-acetylene welding, it is generally specified, although an excellent job of welding can be made with the so-called "fillet" type.

Standards as to strength of different types of joints are now being determined. The preparation of work may involve the squaring of the edges to be joined followed by bevelling, so as to aid in obtaining penetration of the welded metal. Preparation also includes jigging of the parts so as to keep proper spacing and alignment, and in some cases it will be necessary to specify preheating, so as to avoid strains, and annealing to eliminate serious strains.



Oxy-Acetylene welding in a fabricating shop

It is more difficult to specify the welding operation than those steps that are capable of control under material tests. Welding should be done under competent supervision and should not be left to the welder himself. It is good practice to complete a weld when it is once started, and if a weld is permitted to cool off certain things should be done to insure that the job is properly started. Outside of such details, there is little left to the man except to deposit the metal just as he did on his qualification test.

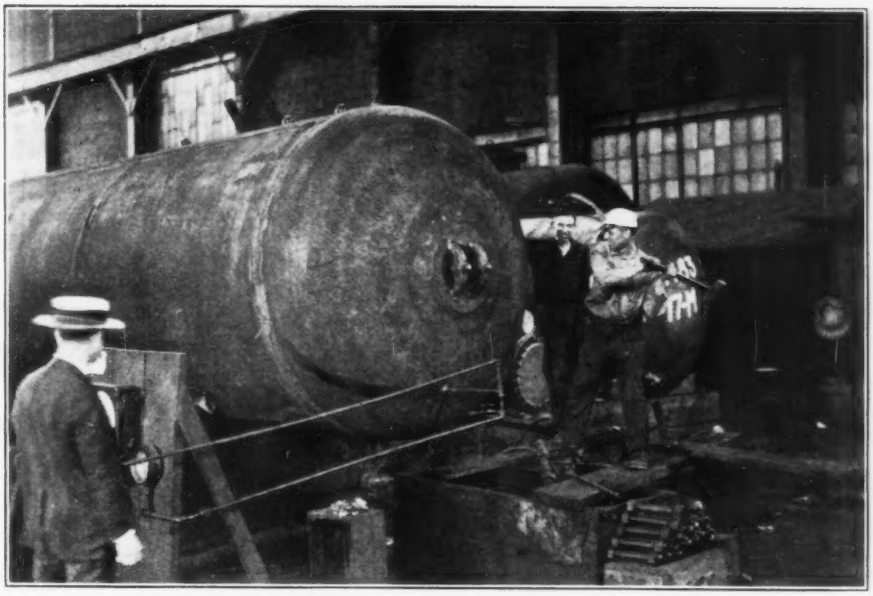
Experience has shown that oxy-acetylene welding does not vary appreciably when a man has proved that he can weld at a certain rate and give certain test results. The welders become accustomed to carrying a certain size bath of molten metal and have certain methods of heating in advance of the welding which become second nature.

Careful study has indicated that any given welder does not change in quality appreciably unless there is a serious change in speed of welding. This points again to the importance of the qualification test, and it would be well to mention that at the beginning of the work on the qualification test, it was learned that a relatively green man could be taught to make high strength weld quite as rapidly as men who had been welding for years who had frequently developed bad habits of which they had no knowledge until given qualification tests.

The testing of welded construction and products is of the same importance as the test of any other class of materials. If possible, a test should be given to each welded article, and in some industries such tests are almost automatic, because of subsequent operations. In these cases, it will be found that oxy-acetylene welding gives marvellous results—some plants not having any rejected welding work over a long period of time, although operating under very rigorous requirements. There is some way of testing that can be adapted to any given problem, and although testing is an item of expense, it is also such a benefit that it probably pays for itself through improvement in workmanship.

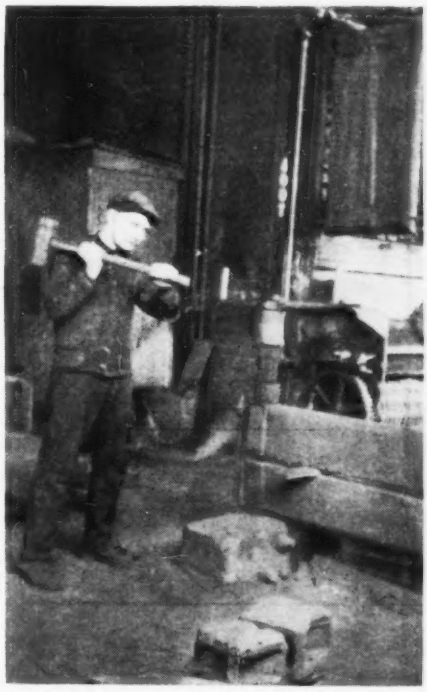
No test can be considered satisfactory unless it shows up defects, if present, and when such defects are noted, a check should be made to determine which phase of procedure control is responsible, that is, workmanship, materials, design of joint, preparation or welding.

Whereas many of the things that have been mentioned above pertain to all welding processes, it is known that the proper application of the oxy-acetylene process can be obtained wherein the welded joint will be fully up to the strength of the rest of the structure. In fact, the joint can be almost neglected in the original design. Larger companies supplying gases and equipment for oxy-acetylene welding are cooperating with industry by having thoroughly qualified men to aid in special operations and to teach the correct welding practices where there seems to be such need, or where there is a request for such service.



Pressure impact test of welded pressure vessel

A further step has recently been made by the assignment to many industrial centers of welding engineers who are graduates of the best engineering colleges and who have been trained for several years in the application of oxy-acetylene welding.



Welder's qualification test specimen being tested by bending

If any plant is skeptical about the use of oxy-acetylene welding, the matter should be taken up with its supply organization and arrangements made for a thorough discussion of the applications of oxy-acetylene welding to its work.

National Brake & Electric Co., division of the Westinghouse Air Brake Co., Milwaukee, has off the press publication No. 828 descriptive of its new air compressor which it claims to be different in design, and having as its most important feature the sleeve valve principle. Quietness and greater efficiency are claimed to be the characteristics of the mechanically operated sleeve type of intake valve.

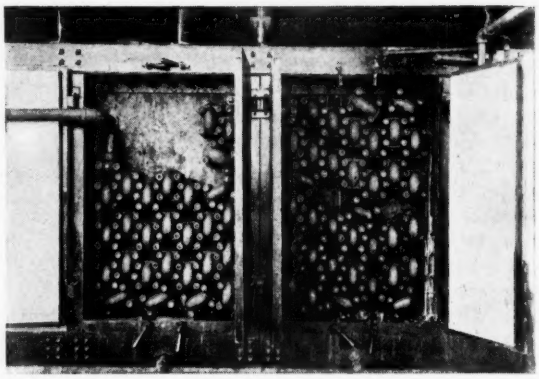
Greater compactness throughout every size without sacrifice of accessibility, less vibration, higher speeds, fewer parts to wear and less wear on each part, better lubrication and high efficiency cooling are other things claimed for the new device.

Both air and water cooled types are furnished. The compressors of SVEH automatic motor compressor outfits have water jacketed cylinder heads and are cooled by a self-contained water cooling system. These outfits are designed for continuous service.

A booklet of general instructions on the operation and care of these compressors and air compressing equipments also has been published.

LOS ANGELES, Oct. 25.—A hand-operated gear grease dispenser with pump and meter has been developed by the Repcal Brass Mfg. Co. here. The device is known as the Repcal Metapump. It registers grease delivery in one-quarter, one-half, three quarters and full pints.

COMPLETENESS OF DESIGN

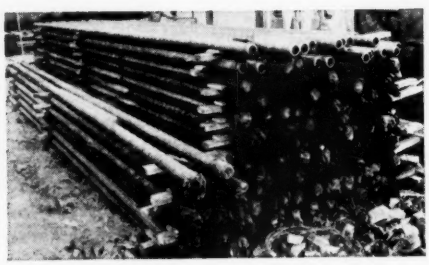


Seco Bends permit close tube spacing as shown in the connection section of this large cracking still.

Seco Bends are locked to the tubes by simply tightening four nuts. They can be installed for a fraction of the cost of other fittings as the skilled labor, time and equipment necessary for rolling-in tube ends is eliminated

The design of Seco Bends incorporates four major features that are combined in no other fittings.

Their interior is streamlined, so that friction is lowered to the "irreducible minimum." The method of locking to the tubes reduces installation costs and permits the rapid removal of tubes for inspection or replacement.



Tubes machined for Seco Fittings are supplied by any tube manufacturers.

There are but two joints for each fitting so that leakage is largely eliminated, and if it should occur, it can be easily stopped by tightening the nuts.

Seco Bends are designed to meet your requirements. Prices or further data will be furnished promptly. Address your inquiry to either office.

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Electric Welding Finds Many Uses In Daily Refinery Operation

By Alexander Churchward*

THE electric welder has become an indispensable tool in the oil refinery for repair and construction work. Electric welding is now common practice on such jobs as fabricating steel tanks from No. 10 gauge to ⅜-inch thick; welding joints in large diameter pipe and pipe fittings; construction and repair work on high pressure stills; construction and repair work on condenser boxes; construction and repair work on dephlegmator plates and towers; welding the caulking edges on gasoline storage tanks; welding a leak in water tank with tank full of water; welding seams on large tank roofs—5000 to 80,000-barrel size; tapping water mains with only momentary interruption of service; salvaging otherwise waste material; making fences from old pipe, and making small tanks from the remains of a storage tank damaged by fire; building truck tanks; fabrication and repairs on heat exchangers and aftercoolers; building and repairing Kelly stems.

A nationally known refiner of crudes in the Mid-Continent area, with whose procedure the writer is well acquainted, has found arc welding to be highly profitable. Electric welding has been used with success on many jobs for which gas welding was not as well adapted. Wilson equipment is used.

Comparisons extending over a number of years have shown that electric welding on some particular jobs is from 30 to 65 per cent less than gas. In oil refinery work arc welds have been found tight, strong and safe.

The supervisor of the plant mentioned is a firm believer in the use of a short arc, and finds that his welders turn out consistently good work by following his instructions as to the size and kind of wire, and the welding current to be used. He also finds that after training his men on short arc welding from only two to three weeks, they can weld all day and only break the arc a few times.

A crew of 14 experienced welders is employed full time on fabrication, erection and repair of refinery and oil field equipment at this plant.

Practically all tanks built by the company (up to 500-barrel capacity) are made with electric welded joints. The sheet steel used varies from No. 10 gauge to ⅜-inch thick, with fully 60 per cent of the tanks being made from ¼ to ⅜-inch plate.

The sheets are formed in the welding shop and then the joint edges are given a "V" cut of 60 to 90 degrees with a gas torch. Wilson No. 17 welding wire, 5/32-inch in diameter, is generally used on the ⅜ and ¼-inch work, using 1/5 pound of wire per foot of welded seam. The welding current is held at 130 to 140 amperes, and the average welder deposits 18 pounds of metal, covering 90 feet, in 8 hours. This makes a very substantial seam. The total cost per foot of weld is $.116 where the motor driven welding unit is used, or $.139 where the gasoline driven units are used.

Large diameter pipe and fittings are usually made up in the welding shop from ¼ to ⅝-inch steel. Joints are "V" cut, 60 degrees on one side. No. 17 wire, 3/16-inch in diameter, is used in making pipe or fittings from ½-inch plate. A welding current of 175 to 200 amperes is regularly used. The average rate of depositing metal is 25 to 30 pounds in 8 hours, averaging 2.125 feet per hour. This gives a good joint 16 to 18 feet long. The cost on 1.2-inch stock is $.672 per foot of welded seam.

Repairing Cracked Dubbs Still

The gasoline driven welding units are used to exceptionally good advantage in connection with repairs on stills. Typical of this work is a job recently completed on a cracked Dubbs reaction chamber.

This is a steel cylinder 30 feet high and 10 feet in diameter, with walls 1⅝ inches thick. Two cracks with a total length of 41½ inches appeared near the top of one of these chambers. The cracks did not run straight through the wall, but drifted upward toward the inside of the vessel, making it necessary to cut a "V" about 3 inches wide on the inside, and tapering to nothing at the outer surface of the chamber wall.

A particularly interesting discovery was made in cutting out these two cracks. A section of the casing between the new cracks had failed in a similar manner some time before, and the two new cracks in the parent metal were apparently extensions of the former crack. The original crack had been repaired by electric welding, and, although the parent metal had again opened on either side of the welded section, the new cracks ran into the weld less than an inch on each end and then stopped. The old weld was perfectly sound but was cut also for safety, making the total opening 52 inches long.

The work required 3/16-inch, No. 17 welding wire, using a current of from 175 to 200 amperes. A total of about 170 pounds of metal was deposited. The welding cost for the entire job was $85.31.

Kelly Stems

The Kelly stem is a large spline shaft used in drilling coke out of the reaction chambers of Dubbs cracking units. It, in conjunction with a bossed casing, provides a means of transmitting the torque from the driven end of the shaft to the drilling end as the stem works its way up through the chamber. The stems are made up in the welding shop from double extra heavy pipe, and 1 by 2-inch steel strips.

The stems are 57 feet long. Three lengths of 6⅝ inches outside diameter pipe are first welded together. Pipe ends are "V" cut and electric welded with three pounds of Wilson No. 17 wire, 3/16-inch in diameter, using a current of 155 to 165 amperes. Average time for welding a pipe joint is one hour.

After the pipe joints are welded, six 1 by 2-inch steel strips are spaced around the periphery of the pipe on 60-degree centers, flatside to the pipe and running along its length parallel to its long axis.

The strips are located carefully and tacked in place by spot welding. The edges of the strips next to the pipe are trimmed off so as to make a "V" with the pipe.

Using a 3/16-inch No. 17 electrode, and 175 to 200 amperes of welding current, any electric welder in the shop can average 70 feet of seam in 8 hours, depositing about 30 pounds of metal. The unit welding cost is $.167 per foot on the strips, and $.789 per foot on the pipe joints.

The original Kelly stem was a solid bar and very heavy. The refinery engineers thought that such a design did not give a sufficiently high ratio of strength to weight and so designed the hollow stems with welded strips. This gives a more efficient distribution of material, and results in a stronger and lighter stem. So far over 30 of these stems have been built

*Technical director, Wilson Welder & Metals Co.

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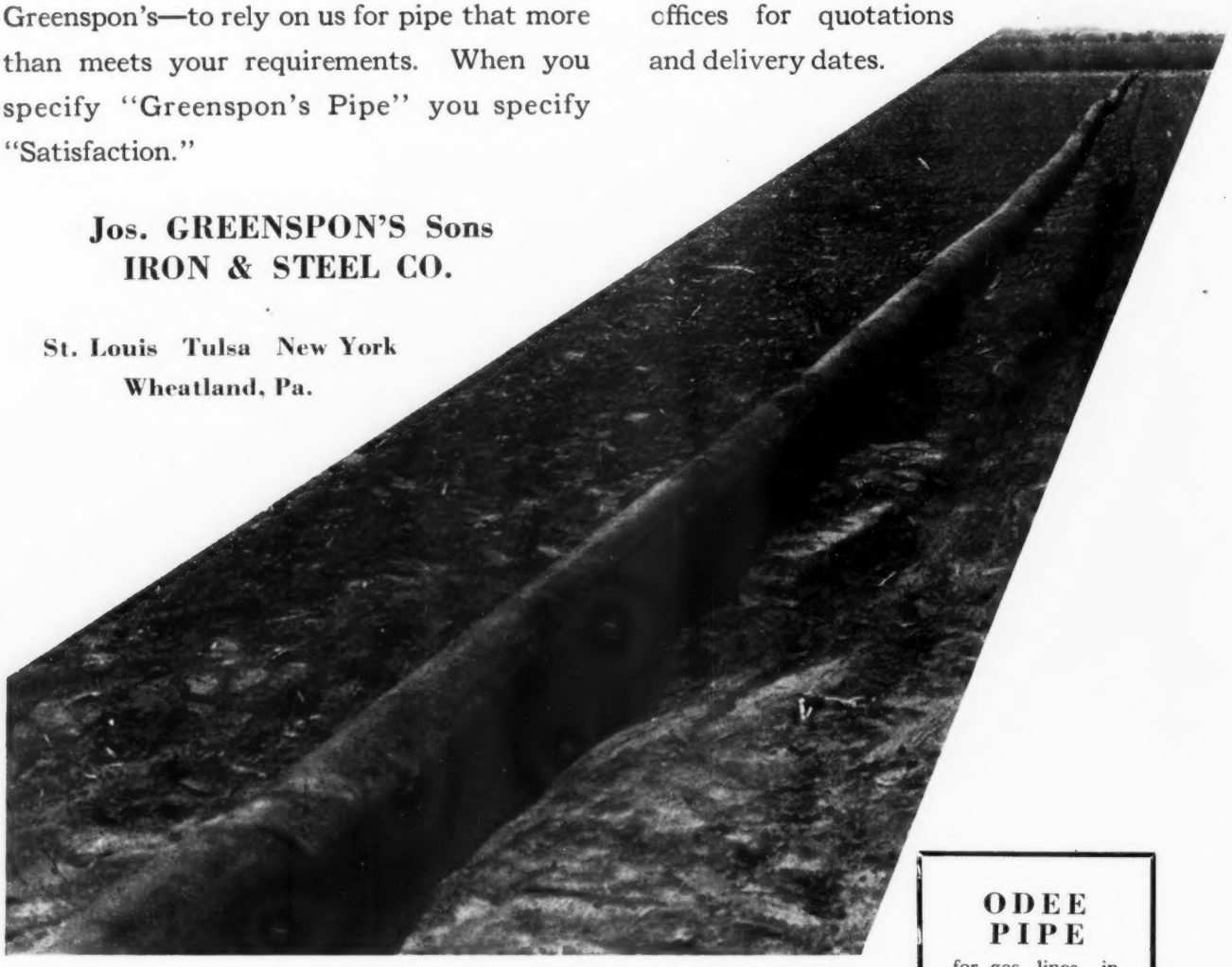

ODEE PIPE

for gas lines, in double lengths to save field welding, was first marketed by Greenspon's.

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at an estimated saving of over $300 per stem, as compared with what they would cost if bought from an outside concern.

Fabrication Work on Heat Exchangers

Heat exchangers and aftercoolers used at this refinery are of identical construction, and are regularly fabricated in the welding shop. A length of pipe 6 to 20 inches in diameter serves as the casing. A nest of small diameter tubes, of the same length as the casing, are welded into flue sheets at either end, the nest inserted in the larger pipe, and the flue sheets attached to the inside of the casing by welding. These units are replacing condenser boxes.

This is another type of job successfully handled with the electric outfits, which could not be done by other methods of welding. In the past two years 30 of these units have been built at a cost estimated to be at least $100 less than the price the company would have had to pay to buy them outside.

The total saving resulting from the adoption of electric welding is difficult to calculate because of the wide variety of work being handled. The various individual savings shown in preceding paragraphs are in themselves enough to indicate that the investment in electric welding equipment is paying good returns.

Progress in Cracking During Past Year

Proprietors of Two of the Leading Processes Give Their Ideas on 1929 Developments

By C. W. Nofsinger
M. W. Kellog Co.

THE various cracking processes have come to the use of crude and fuel oil as charging stock. In case of operating a Cross cracking unit on crude, the crude may either be charged direct to the mixing tank, or the gasoline and kerosene may be flashed off in a separate flash tower, making use of the waste heat from the cracking operation for preheating the crude in either case.

Other cracking units have also been operated on crude in this manner. The topped crude from the preliminary flash may either be charged to the regular mixing tank on a Cross unit and cracked mixed with recycle stock or it may be given a light crack and then be discharged into the regular Cross evaporator, the fuel oil passing down and the gas oil vaporized and then being condensed together with the recycle stock at the bottom of the bubble tower and thus being cracked in the usual way.

In the latter case an auxiliary furnace is used for precracking the topped crude, the furnace being designed for the production of a small yield of gasoline and the distillation of the gas oil for charging stock. Although the charging of topped crude direct to the old Cross unit produced a good yield of gasoline, the on stream time was only from four to six days due to the accumulation of coke in the reaction chamber.

For this reason the method of precracking the topped crude to obtain greater on stream time was to be preferred even if a slight reduction in gasoline yield was the result. An improvement has recently been made which increases the feasibility of operating a Cross unit on topped crude.

A very simple change in processing apparently reduces the polymerizing action of the heavy hydrocarbons to coke in the reaction chamber, thus reducing coke formed per barrel of charge and lengthening operating time. On a standard 2000-barrel Cross unit thus equipped when operating on Winkler county, Texas, crude, the coke per barrel of crude was 0.28 pounds when producing 62 per cent of 420 end point gasoline and Bunker "C" fuel, the reaction chamber being only 1/3 full of coke at the end of a 14-day run. Operation without this improvement would have produced approximately 2.8

(*Continued on Page* 154)

By W. F. Moore
Engineering Dept. The Texas Co.

THE developments in cracking in the industry at large during the past 18 months have been of a different character than those of the preceding period.

Prior to the year 1928, or thereabouts, developments in cracking were directed to a marked degree toward greater recovery of motor fuel from the crude. This may be called the period of "quantitative development."

While developments of this character are still progressing actively in some quarters, there has been a definite trend in development towards improvement of quality of the motor fuels produced by cracking. Thus, it may be said that we have entered a period of "qualitative development."

The developments during this period have been directed chiefly toward the improvement in the anti-detonating properties of motor fuels, which has led to extensive developments in the field of vapor phase cracking.

We have, during the past year, seen the vapor phase process become a commercial reality, the design and operation being such that the low boiling fractions produced, which come within the boiling range of motor fuel, may be used as a blending stock comparable to benzol and other materials of this character now being extensively used to improve the anti-detonating quality of motor fuels.

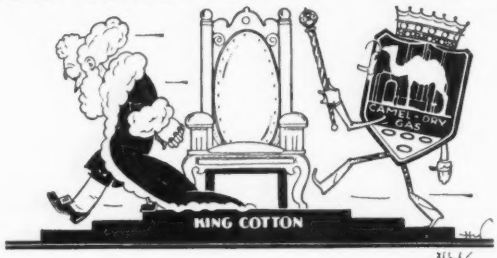
Other developments of this character have had as their objective the improvement in the anti-detonating properties of the motor fuels produced from liquid phase cracking processes through the use of relatively higher temperatures with increased soaking time on the vapors and decreased soaking time on the liquid.

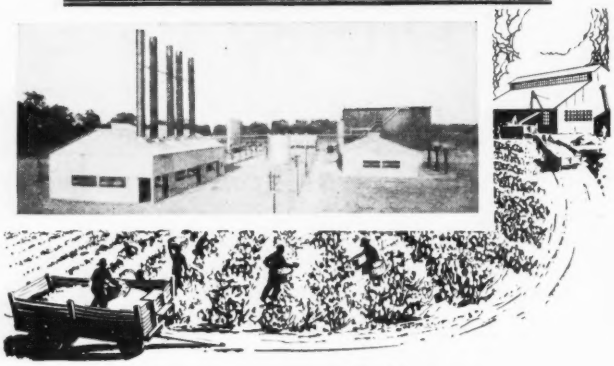
The effect of this is the production of a cracked motor fuel having an anti-detonating value such as to meet the requirements of the present general market, but not of sufficiently high anti-detonating value to use to any extent as a blending stock.

The advent of the commercial vapor phase process, the use of higher temperatures on existing cracking processes and chiefly the refining of stocks of a more corrosive nature have brought about developments in the manufacture of alloy metals, the use of which tends to lengthen the life of the cracking equipment, as well as other refining equipment.

(*Continued on Page* 155)

Billions of Bubbles





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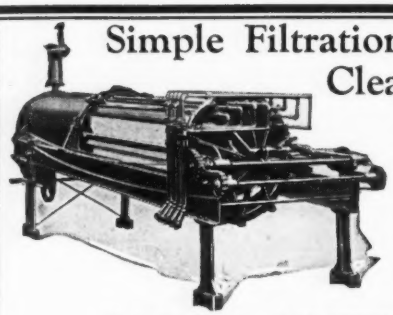

THERE'S nothing complicated or bulky about the Oliver United filter used for cleaning up pressure still residuum.

The filter can take the residuum straight from the still while hot or from storage, pre-heating only to make it fluid, and deliver a clean, marketable product at mighty low cost.

Plants already using the Oliver United system report that costs—all costs—run less than 5c a barrel.

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Progress in Cracking

By C. W. Nofsinger

(*Continued from Page* 153)

pounds coke per barrel crude charged and the run would have been less than half as long.

Another development which promises greater yields from fuel oil and other heavy stocks is the operation of a Cross high pressure cracking unit to an ultimate yield of gasoline, coke and gas. Yields of from 60 to 65 per cent of gasoline from topped crude makes a good yield of gasoline possible from many charging stocks.

The regular Cross unit is changed to the extent of substituting two coke drums for the reaction chamber, one coke drum being used while the other is being cleaned, thus operating time is increased. The method of using two reaction chambers, operating on one while the other is being cleaned has been used for some time on Tube and Tank units.

There is another improvement which has considerable merit and that is processing the fuel oil from a Cross unit without the further addition of heat in separate equipment for more recycle stock. Thus the fuel production is decreased and the gasoline yield is increased. A marketable fuel, a heavy liquid fuel, or a hard pitch may be made in this way. The hard pitch may be pulverized and burned if it has a high melting point.

Stabilizers for eliminating the wild ends from cracked gasoline are being placed in operation. This practice is being taken direct from the natural gasoline industry and the lessons learned in that part of the oil industry are being taken advantage of in adapting this improvement to the cracking process.

Vapor phase cracking processes are coming into more general use because of the demand for anti-knock gasoline. The use of this product for blending to improve the anti-knock properties of ordinary straight run and cracked products is making its manufacture very profitable.

Also, this process has been improved to the point where it rivals the ordinary cracking processes in point of yield of gasoline. The treating of the unsaturated product from the high temperature cracking has been improved but the reduction of gum content to the required figure is still a problem. The fuel required for vapor phase cracking still remains at a high point.

The amount of gas produced in this type of cracking is higher than in the liquid phase units but the production of fuel oil is less. The unsaturated gas from vapor phase cracking gives promise of producing the raw material for making alcohol and other valuable products.

Better furnace design has aided the

development of this type of cracking as exemplified by the De Florez vertical radiant tube type furnace.

Many improvements have been made for the better control of the cracking process, including automatic furnace control, flow control, liquid level control and arrangement for complete control of pressures, temperatures, etc., from a central point.

This has all been developed gradually from experience in actual operation and better design and care of instruments for accurate control. Furnace designs have been devised to make use of radiant heat input to reduce flame temperatures without fear of trouble from overheating the oil. Air heaters and flue gas recirculation have been used with success to obtain high thermal efficiency and yet maintain mild flue gas temperatures for controlled heat input.

The advent of recycling of the hot uncracked gas oil or recycle stock has caused the development of many types of hot oil pumps. The steam engine driven hot oil pump is finding its place where steam economy is essential. The past year has brought forward at least one type of high pressure hot oil centrifugal pump which has met with a great deal of success.

The many types of cracking units in use today are gradually being improved on the basis of increased yields, and for lower fuel, operating and maintenance costs.

Progress in Cracking

By M. F. Moore

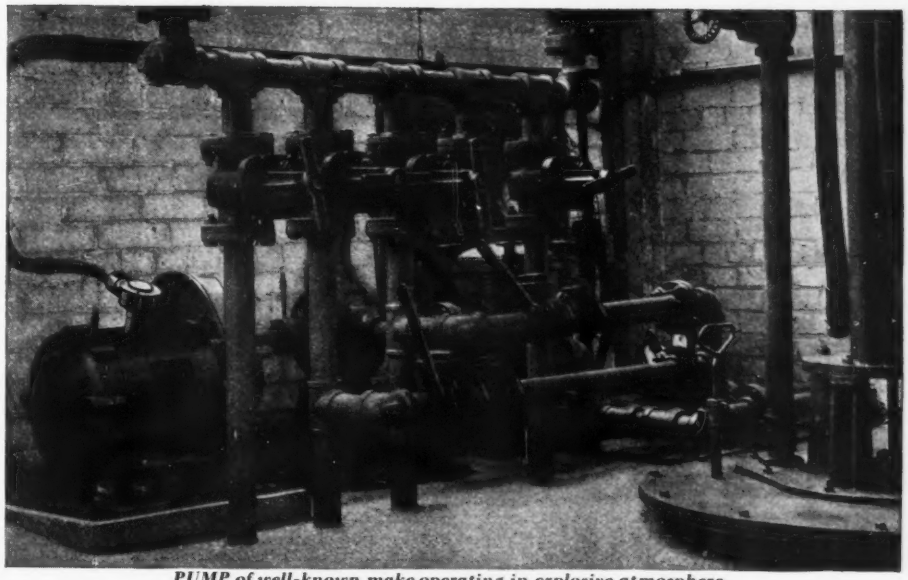
(*Continued from Page* 153)

Attendant with this development in materials has been a progressive development in heater design, one of the most outstanding results being that of the vertical tube type which has been in successful commercial operation for some months and has proven a great aid to the safe use of the higher temperatures.

These new designs in heaters tend to increase the efficiency through the greater and more effective use of radiant heat. This permits greater capacities per unit of investment cost and improved control in operations which in turn make for a more uniform quality of product.

The cracking pipe still is another development that has come to the forefront during this period and has become increasingly popular particularly among the smaller refiners.

Its development has apparently grown out of the high pressure liquid phase cracking processes and has as its objective a simplified design of equipment. It is believed, however, that any advantages gained will be at the expense of the motor fuel yield from cracking.



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Warning! Do not confuse the Louis Allis "EXPLOSION-PROOF" Motor with so-called "vapor-proof" motors. Real "EXPLOSION-PROOF" motors must be especially constructed and must pass severe explosion tests to be approved by Underwriters' Laboratories for use in explosive atmospheres.

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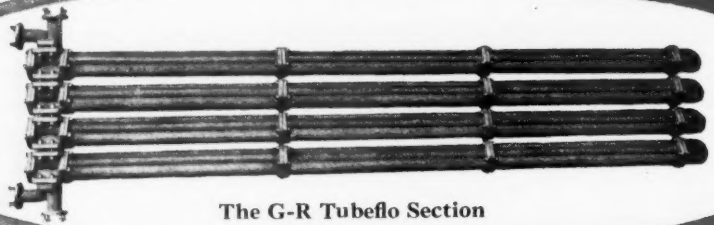


The G-R Tubeflo Section

The G-R Vaneflo Exchanger

Generally, it appears that the developments in cracking during the past 18 months have increased the general efficiency of the processes, brought about improvements in materials and equipment of both the high pressure liquid phase and the vapor phase types which in turn has opened ways and means for the improvement in the ultimate quality of both the natural and the cracked motor fuel production from the refinery.

Modern Construction of Still Furnaces Gives Better Performance

By E. V. Rinehart*

THE old fashioned idea of furnace design was great masses of brickwork, with arches thrown up this way and that to take care of any opening that might be necessary. Heat was applied in an arbitrary fashion with the intention of supplying the total number of B.t.u. that would be required, and dependence was placed on soaking effects to bring about such uniformity of temperature as could be had. Great deterioration took place in the brickwork, but this was anticipated and to some extent offset by the thickness of the walls.

With improvements in refractories during the last quarter century furnace walls have been made thinner and thinner. Steel has been developed for structural support to replace piles of masonry; suspended arches have come into vogue, firing and heating methods have been improved, and definite principles of design have been brought into play in connection with combustion chambers and heat transference.

The development of high temperature insulation suitable for use on stills and settings has also been responsible for many of the advantages that accrue from modern construction. In the early days of the refineries very little insulation was used. In the first place suitable furnace insulating materials were not available. In the second place the thick walls to a small extent took the place of insulation by offering with each 9-inch thickness of brick about the same resistance to heat flow as would be accomplished by 1 inch of good furnace insulation.

The thick walls operated at their greatest disadvantage when used on intermittent furnaces. On continuous furnaces it was found to take months before heat flow in the walls and hearths became sufficiently constant to justify the assumption that furnace temperature conditions were reasonably stable. Therefore, the natural and logical consequence of intermittent operation was a continuous state of varying furnace conditions. Besides the unsatisfactory character of heating that could be done by such furnaces, the further result was great wastage of heat by allowing the heavy walls to soak it up only to dissipate it again when the furnace was shut down.

In present day practice, it is still true that heavy duty furnaces require thicker walls of brick than in the case where refractory conditions are less severe, yet walls are much thinner than were formerly used. Today it is an unusual condition, where a high wall is combined with a heavy load or high temperature, that really demands a brick wall thickness of even 22½ inches. A good average thickness of refractory for ordinary

*Staff manager, oil industry, Johns-Manville Corp.

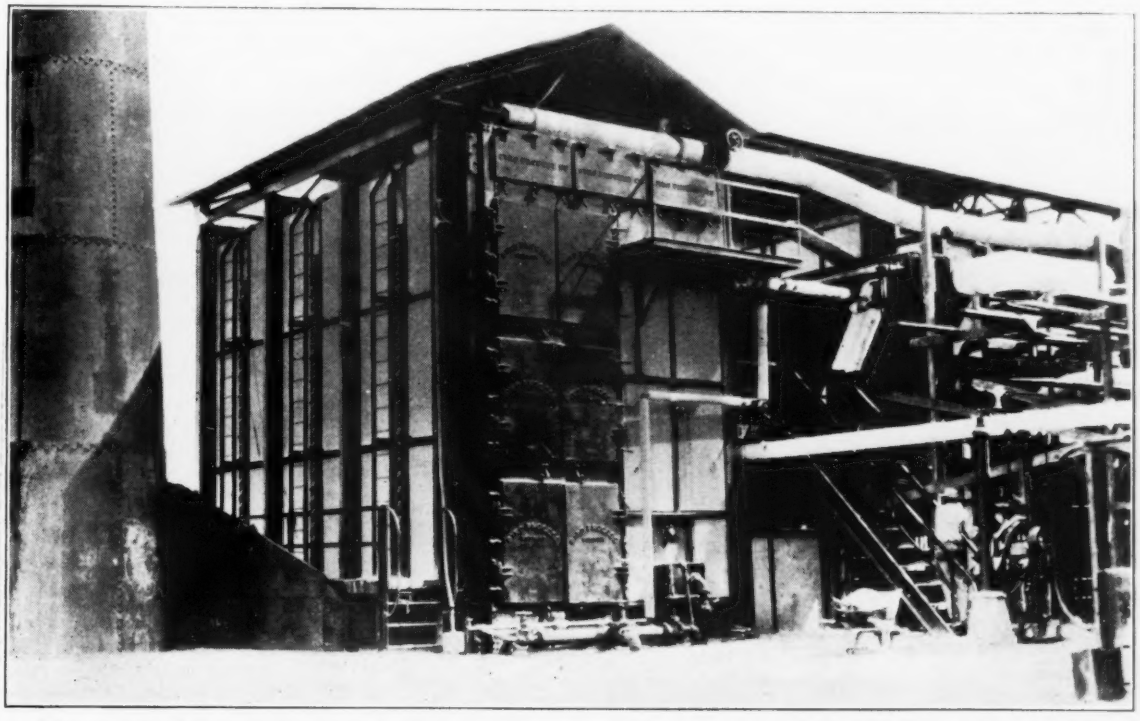


Fig. 1—A Gyro economizer, Transite cased, reminds one of a machine rather than a furnace

Fig. 2—High temperature block insulation is readily adapted to brick settings cased with Transite

furnaces is 13½ inches, but the average should be less for markedly intermittent operation. Where walls are thin and circumstances demand, the brick can be tied to the buckstays to prevent "walking."

Better grades of firebrick and special brick for particular applications are largely responsible for the modern trend as above described. Much development work is still to be done, but progress is being made, and on this progress is dependent the entire future course of furnace economy. Designers are at work improving heating equipment, and refinements are being made in types and methods of building furnaces, but the limitations of all seem to be defined by the limitations of the furnace brickwork. There is a continual demand for better and better refractories.

The fusion test for firebrick is not important in refinery practice because any good firebrick fuses at a higher temperature than those encountered in ordinary still operation. Absence of spalling with rapid temperature change is much more important as is also the ability to resist deformation under load when heated to furnace temperature.

Insulation:

The growth and development of insulation suitable for use on furnaces has been coincident with that of the refractories in connection with which it is used. The necessity for materials designed to retard heat flow arose as a corollary to the use of thinner walls of better grade brick as well as increasing demands for higher efficiencies.

The fact that it is far preferable to minimize heat losses by the use of insulation rather than by using very thick walls is emphasized by this illustration: *an 18-inch firebrick wall insulated with a 4-inch thickness of high grade insulation will transmit less heat than a solid refractory wall 60 inches thick.*

The first reason for using insulation is to limit heat flow from the hot interior of the furnace, in order to reduce the fuel expenditure necessary to maintain the furnace temperature. Raw fuel has steadily increased in price during recent years, and modern construction has eliminated the great thickness of brick that formerly tended to cut down heat loss. Both of these factors point directly toward the use of an efficient material to bar the flow of heat from inside of walls and arches. When it is considered that heat loss from one square foot of bare surface often amounts to a matter of dollars per year, the proper emphasis begins to be laid on insulation which will save a major portion of this loss.

As an example, suppose a 2400 degrees Fahr. furnace with 18-inch firebrick walls is uninsulated and operates continuously in such a manner that the worth of furnace heat is $.40 per million B.t.u. The dollar equivalent of the heat loss then amounts to $2.67 per square foot per year. When these walls are insulated with 3 inches of high quality insulating blocks this loss is reduced to $1.21 and the saving is $1.46 per square foot per year. In such a case the investment represented by the cost of the insulation is repaid by the savings in operating cost long before the end of the first year's use.

The heat that is retained in the walls by virtue of the insulation works to raise the mean temperature of the refractories. This minimizes the temperature differential between inside and outside of the brick which lessens internal strains and reduces spalling effects. Akin to this are the fewer and smaller wall cracks that appear due to uneven expansion and contraction.

Insulation itself, if properly applied, tends to seal cracks in furnace walls, thereby operating to prevent the infiltration of air or the extrusion of furnace gases. In some applications this feature is of even more importance than the saving of heat and reduction in fuel cost.

When insulation is placed over the exterior of furnace brickwork, resistance is introduced in the path of heat flowing directly to the outside. This promotes heat flow along the length of the walls and cooler portions of the furnace are raised to a higher temperature. Sharp temperature changes

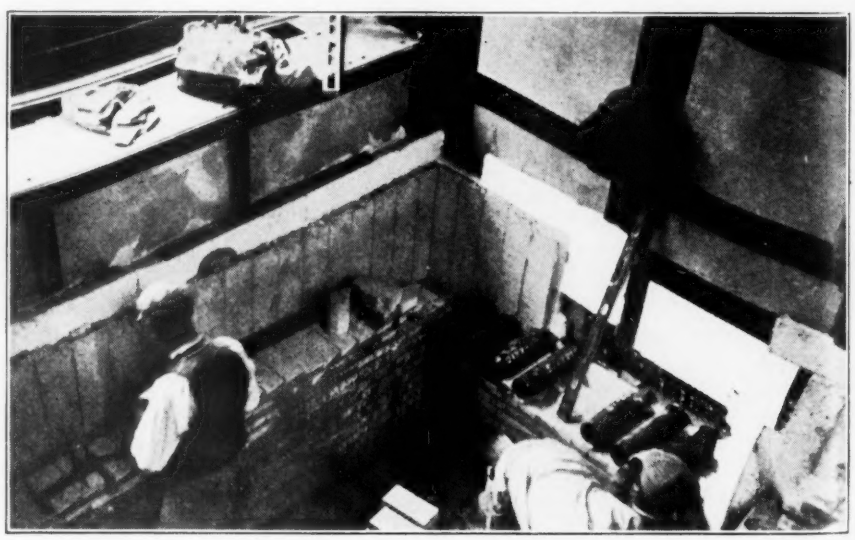


Fig. 3—Transite casing is first erected. Then two layers of insulating blocks are fitted in place and the firebrick laid snugly against the insulation

are obviated and adjacent brickwork is protected against widely varying rates of expansion. Lower temperatures may be used in the heating zone and still adequate temperatures maintained throughout all portions of the furnace setting. This saves fuel and still further prevents deterioration of the refractories.

It is usually true that the capacity and efficiency of a furnace are directly dependent upon the operating temperature. With the improvements that have taken place in refractories, and the protection against internal stresses afforded to the brickwork by insulation, we find a recurrence of efforts to carry on at higher and higher temperatures.

Here again we are limited by the heat resisting properties of the refractories that are available, but the tendency seems to be in the direction indicated.

However, increase in production and improvement in operation do not wait upon the use of increased temperatures. The saving of heat, the uniformity of temperature, and the elimination of air infiltration, which may be obtained through insulation have resulted in attainment of both these advantages.

In the matter of insulating materials for furnace work, the principal considerations are insulating value, adaptability, durability, price and temperature range within which suitable physical characteristics are maintained. Several different forms of insulation are available in the market, such as blocks, bricks, cements and filling materials. Generally speaking, the proper use of insulating cements is limited to finishing purposes for the protection of the surface and the sealing of joints between insulating blocks or bricks. Sometimes insulating cements are applied as a special sort of filling material.

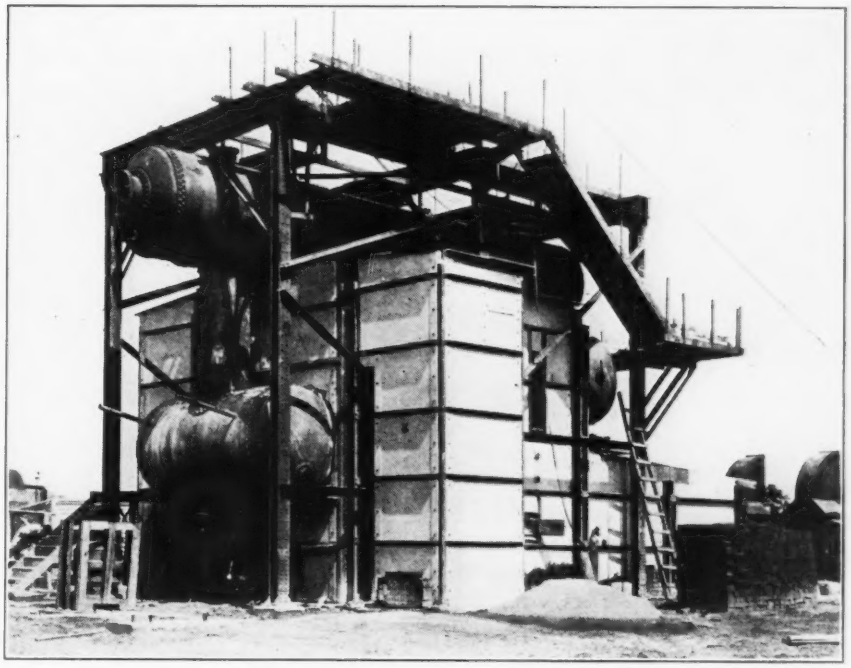


Fig. 4—Jenkins cracking unit in process of construction. Transite asbestos sheets provide a durable, weather-proof casing

Filling materials of whatever sort are properly utilized where conditions render impractical the use of solid insulation such as blocks or bricks. The better grades of solid insulation are wholly reliable as to quality, conductivity, strength, and stability in service. Filling materials depend chiefly upon the human element for their proper application. Even the most careful use of filling materials will not insure stability or overcome settling in service.

Fig. 5—High temperature insulating brick in furnace setting of Cross cracking unit laid in "core wall" construction

Insulating brick have the advantage that comes from the mason's familiarity with these shapes and his usual preference to work with them. In some types of construction the bonding feature of brick shapes is also important.

The convenient sizes of block insulation (6 by 36 inches or 12 by 36 inches) decrease the cost of applying the material, and reduce heat transmission through the insulation, because the number of joints is minimized, and in two-layer work through joints are practically eliminated.

For foundations, bases and some other uses insulating concrete has proven highly effective. This material is made by mixing a specially prepared diatomaceous silica aggregate with portland cement in the proportion of 4 to 1 by volume, and adding only sufficient water to make a plastic mixture. Such a concrete is three times better than firebrick in insulating quality, will withstand 1800 degrees Fahr., and has a crushing strength of 1,000 pounds per square inch.

Furnace Casings:

The modern furnace wall is cased with Transite asbestos sheets or with steel plate. Transite asbestos sheets, ⅜ inch thick, have been adopted by many of the leading designers of refinery furnaces throughout the country.

Furnace construction necessarily calls for considerable brick-work and steel projecting through to the outside of the insulation from the hotter

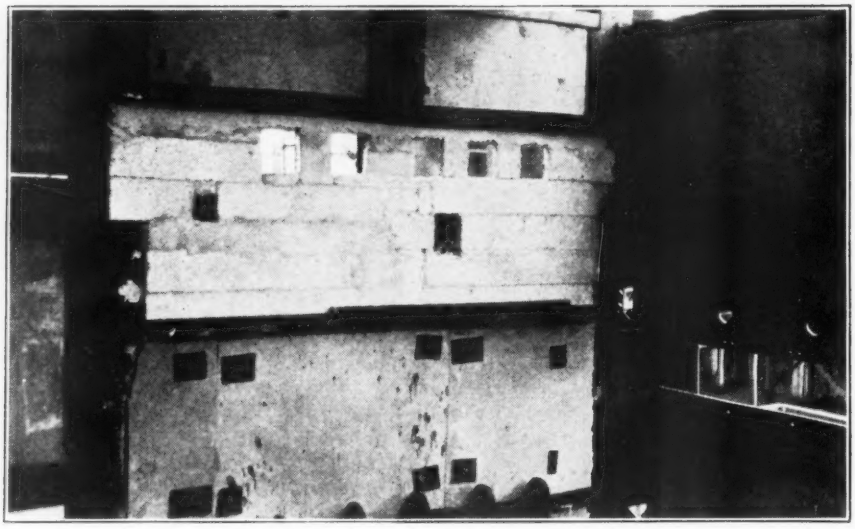


Fig. 6—Interior of air-cooled casting on Gyro converter. Insulating blocks are fastened between panels of Transite erected on the supporting steel

portions of the furnace and this through brick and metal conducts the heat to the casing. Generally, Transite is not considered a heat insulator, but it has a low enough conductivity to prevent the casing from readily picking up this heat and carrying it along the surface to be rapidly dissipated in the air.

The ⅜-inch thick flat sheets weigh 4 pounds per square foot, and may be secured in sizes 36 by 48 inches, 42 by 48 inches and 42 by 96 inches. The natural gray color of Transite presents a pleasing appearance and makes it a poor radiator of heat. The material is fireproof, resistant to acid and alkaline vapors, requires no painting, and will last indefinitely.

Brick Settings and Core Walls

There are several methods of applying insulation over brick settings which are equally efficacious but applicable to different constructions. All of these methods involve the use of insulating blocks or bricks, and care is taken in each case that the main supporting steel be left sufficiently exposed to the air so that its strength will not be affected by the heat.

It has been found entirely satisfactory to apply suitable insulation between the brickwork and buckstays except at places of unusual thrust, such as opposite the arches, or where castings and steel work are to be hung into the brickwork. In such locations the firebrick is carried through the insulation to the outside of the furnace.

When it is expedient to erect the furnace brickwork before the casing is applied, a space equivalent to the thickness of the insulation is left between the outside face of the brick and the inside face of the buckstays. Then insulating blocks or bricks are erected to fill this space and Transite casing secured in place flush with the back of the buckstays by steel battens and toggle bolts, or by other suitable means.

When the furnace brickwork is erected flush with the back of the buckstays, light angles may be clipped or spot welded to the buckstays to allow the application of insulation between vertical steel members. These angles serve to support the casing which may be ⅜-inch Transite or ⅛-inch steel.

In oil refinery practice it is customary to erect casings before brickwork. The insulation is applied next to the casing and the firebrick laid snugly against the insulation.

In some furnaces firebrick, insulating brick, and red brick are used in so called "core wall" construction. This is done by laying 4½-inch insulating brick between the firebrick and red brick and bonding at every fifth course vertically. Opposite the hotter portions of the furnace calcined diatomaceous silica brick is used and elsewhere uncalcined brick of the same material is entirely satisfactory. A rubbed joint of insulating mortar is used in setting up the insulation core.

Air Cooled Walls

The designers of several of the well known processes have found that ordinary brick settings may economically be replaced by air cooled walls and suspended arches over the hotter portions of the furnaces. In all these designs air is drawn over the exterior brick surfaces (suspended or otherwise) either by fans, by natural draft or by burner induction. Sometimes it is admitted to the combustion chamber around the burner, and sometimes through auxiliary secondary air openings. The circulation varies with the different designs, but it is always necessary to make use of some sort of casing over the air passages.

This casing governs a vital part of the successful air cooling system, and there have been interesting developments suited particularly to the purpose of enclosing the airways. Whatever kind of air passages are provided over the surface of the furnace walls, their function is to retain the heat recovered by the air, furnish a suitable clearance for air travel so that adequate scrubbing action is combined with the elimination of undue friction loss, and prevent the infiltration of air which would interrupt the flow over surfaces to be cooled.

Furthermore, the construction should be fireproof and able successfully to withstand abrasion, ordinary mechanical impact and high temperature.

A favorite casing specification is made up of outside panels of ⅜-inch Transite asbestos sheets, 1-inch high temperature insulating blocks, and inside panels of ⅛-inch Transite sheets. Sometimes steel is used for the outside panelling and sometimes red brick is used without any insulation.

The usual refinery practice in putting up the panels consists in first erecting the exterior casing, then applying the insulating blocks on the inside with fibrous adhesive and finally bolting the inner casing through the insulation to the outer casing. The furnace brickwork is erected after the casing over air spaces has been completed.

The construction offers superior insulating qualities with a minimum of thickness. Proper clearance is provided for air travel with resulting elimination of friction losses and corresponding reduction of power to fans. The casing may be made impervious to air leakage, is fireproof, and will withstand temperatures higher than are ever required of it in practice.

Refractory Cements

A discussion of means and methods for protecting and extending the life of refractories would be incomplete without some mention of improvements that have been made in the last twenty years on the bonding of firebrick. During this period refractory cements were originated, developed, tried and proven to be of great importance in reducing maintenance of refractories.

In best furnace practice a material is needed to bond the bricks as well as take up irregularities of shape. Fireclay is merely a filler and has no bonding strength or high temperature resistance. It shrinks badly, crumbles away and blows out of the joints, exposing the edges of the bricks to the action of flame and ash. The evil effects of this exposure are apparent to anyone who has looked inside a furnace setting.

By the use of a suitable refractory cement, several notable advantages are brought about. Heat losses are cut

down by eliminating open joints between the bricks. This further assists in protecting the insulation from furnace gases and vapors. Air which might otherwise be drawn in through the walls is excluded by the tight setting which results from application of a strong cement.

A furnace wall may be made to stand up against higher temperatures than the bricks themselves could otherwise withstand if heat is prevented from entering the setting through cracks, thereby softening the bricks at some distance from the surface. Open joints also increase spalling effects, because there is no possibility of an even temperature gradient from one face to the other.

The erosive action of oil flames is also an item of some concern. A setting with tightly sealed joints and brick pores filled by wash-coating with a suitable refractory cement is the best protection that it is possible to obtain. The wash-coating also tends to prevent disintegration by the action of furnace gases.

Where refractories are spalling, the deterioration may be slowed down considerably by a ¼ to ½-inch plaster coating of the proper refractory cement bonded directly to the interior of the setting. Walls whose life could be measured by weeks have thus been made to last many months.

If the brickwork has failed locally, instead of replacing the destroyed brick, it is frequently economical to make a hole in the setting and pound in suitable plastic firebrick material.

Where brick are being laid up with refractory cement the joint is best protected by tapping the brick into the mortar until the joint between the bricks is from ⅛ to 3/16 of an inch thick and the cement squeezes out between the edges of the brick. This extruding cement should be troweled back over the face of the joint and brick to make a T-joint for the protection of the edges. For brick to brick-joints thin refractory cement is used, and all faces of the brick that will come in contact with brickwork already in place, are dipped in this mixture of soup consistency.

The cost of the better grades of refractory cements (the only ones economical to use) is about 5 or 6 per cent of the total cost of the setting. It only takes a few weeks of increased life of the brickwork to retire this investment, and the usual effect of the proper application of suitable refractory cements is to lengthen the life of a setting by many months.

A refractory cement should have a base similar to the brick used in the setting, and should be chemically inert to the action of the furnace. It should have a temperature resistance equal to or better than that required of the brick, and should bond firmly without undue shrinkage. The cement should be readily workable and ordinarily should not vitrify until exposed to furnace heat, in order to allow for readjustment that takes place in the setting during the initial firing.

All of the correlating properties of insulation, of refractory cements and of the refractories themselves, when taken to advantage in the most approved manner, operate to place at the disposal of the modern user of refinery furnaces a production which, as to quantity, quality and economy, was literally unheard of prior to the last decade.

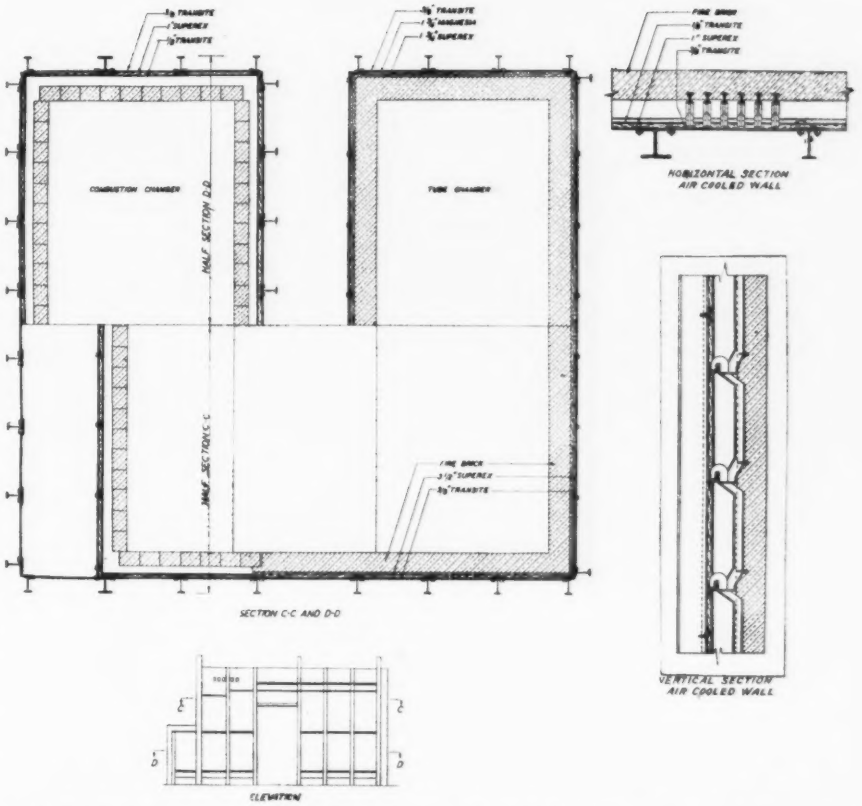


Fig. 7—Insulated Transite panels form the casing over airways of the ventilated portions of the setting. On the brickset portions of the customary Transite insulation, firebrick construction is used

Makes Fabric Insulation For Pipe Lines

CHICAGO, Oct. 24.—Three types of fabric wrappers for insulating material in sweaty places where the action of moisture, acid and alkali destroy the insulating properties, are being manufactured by the Dearborn Chemical Co., 310 S. Michigan Ave.

The No-Ox-Id-Ized fabric wrapper in brown was the first to be used on underground pipe lines, the company says, to protect the undercoating of No-Ox-Id from soil actions. Its gray fabric wrapper has added physical and chemical properties.

The third type which it calls the No-Ox-Id-Ized asbestos felt wrapper is made especially for underground application and is claimed to be flexible, waterproof, and one that withstands excessive changes of temperature.

WASHINGTON—A fully equipped laboratory for investigating oil storage tank corrosion near Borger, Texas, has been established by the petroleum experiment station of the U. S. Bureau of Mines, Bartlesville, Okla., and by the state of Oklahoma. The investigation is being conducted in cooperation with the Gulf Oil Co. the Parkersburg Rig & Reel Co., and the Aluminum Co. of America.

Water and gas analyses, photomicrographs, and various sulfur determinations for water, oil and gas have been established on the lease, and many observations are made on the tank battery of the Gulf company near Borger, which consists of an all aluminum flow and stock tanks and all-steel stock tanks.

WASHINGTON—A dynamometer test on refined shale oil gasoline was recently made by the U. S. Bureau of Mines in cooperation with the state of Colorado. The gasoline used was refined by low temperature sulfuric acid treatment. Electrical horsepower developed was 30.43 which was an increase of 4.03 per cent in horsepower over the petroleum gasoline.

NEW YORK—General Refractories Co. here has appointed the Desch Supply & Equipment Co., Baltimore, as its high temperature cement dealer representative in Maryland. The company will handle Grefco Chrome high temperature cement and Standard silica bonding cement.

Increasing Cracking Coil Capacity By Means of Heat Exchangers

By C. H. Leach*

THE attention of the oil industry has been focused on the cracking processes as the only means of economically meeting the increasing demand for lower endpoint gasoline of definite boiling range and with anti-knock qualities.

A few years ago cracking plants were operated solely to supplement the ordinary crude still operations. The earlier cracking processes were costly in operation as compared to crude distillation. The profit from the conversion of cheap gas and fuel oils into motor fuel at war prices was at first sufficient to make their installation pay.

The incentive to improve the thermal efficiency of the processes and to reduce the operating costs appeared when the market demanded more volatile products which could not be produced economically by the old cracking processes. Then large scale cracking units were constructed, scientifically designed and equipped with heat exchangers.

Higher temperatures and pressures were resorted to; improved fractionating towers were installed. Recently development has been very rapid. A modern cracking unit has three times the capacity of the same type of unit as constructed three years ago. The greater capacity is due not only to the building of larger units, but also to the more extensive use of heat exchange apparatus.

This discussion will be confined to the application of heat exchange on the liquid phase processes as they have been more extensively developed on a commercial scale.

Some form of heat exchange is essential to effectual operation of liquid phase systems which require the charge to be circulated more than once through the heating coils in order to secure ultimate conversion to naphtha as one product, and heavy residuum or tar as the other. The unconverted fraction discharged, with the naphtha product, from the vaporizer is in the superheated vapor state.

C. H. Leach

Whether it is to be retained in the cycle as in the case of internally recycled systems, or withdrawn from the cycle to be later recharged with additional fresh stock, it must be desuperheated, condensed and cooled in order to fractionate the naphtha product out of it. The latent heat of the recycle stock has to be removed at some point in the system.

The heat is available on leaving the vaporizer at high temperatures and can be used most advantageously for preheating the combined feed to the cracking coil. By the employment of heat exchangers of the fractionating type, only the recycle stock is condensed, permitting the lighter fractions to pass into the bubble tower. Heat is recovered and partial fractionation effected by the heat exchanger.

Suppose that heat exchangers are not installed and the recycle material not condensed at this point. Cooling must then be supplied at a low temperature in the form of reflux to the bubble tower. The volume of cooled liquid which must be returned to the tower is far in excess of the reflux required for fractionation alone.

The lower plates of the tower serve primarily as condensers, knocking back the recycle stock; fractionation is limited to the upper section. Also,

*President, C. H. Leach Co.

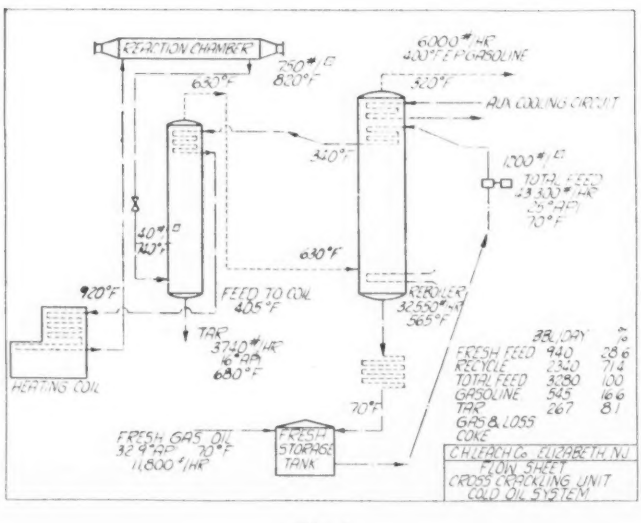


Fig. 1

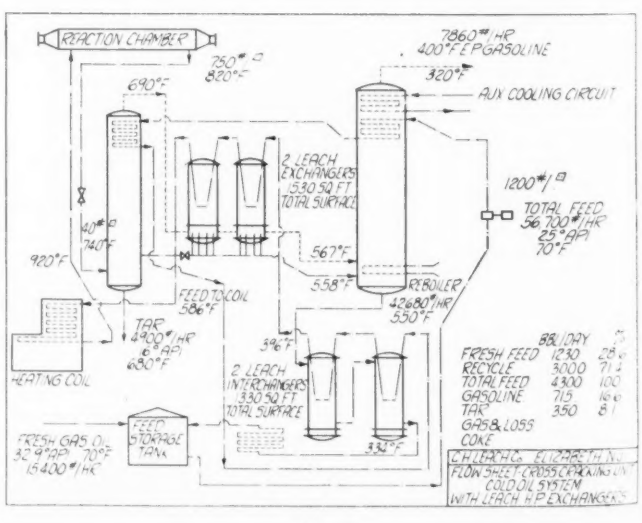
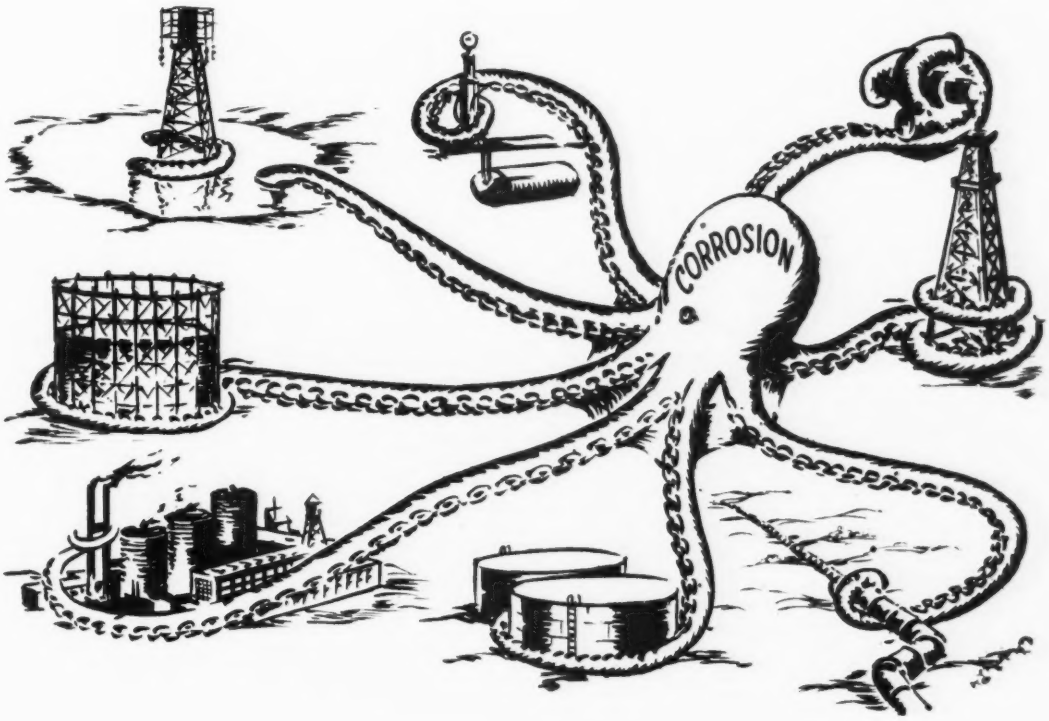


Fig. 2



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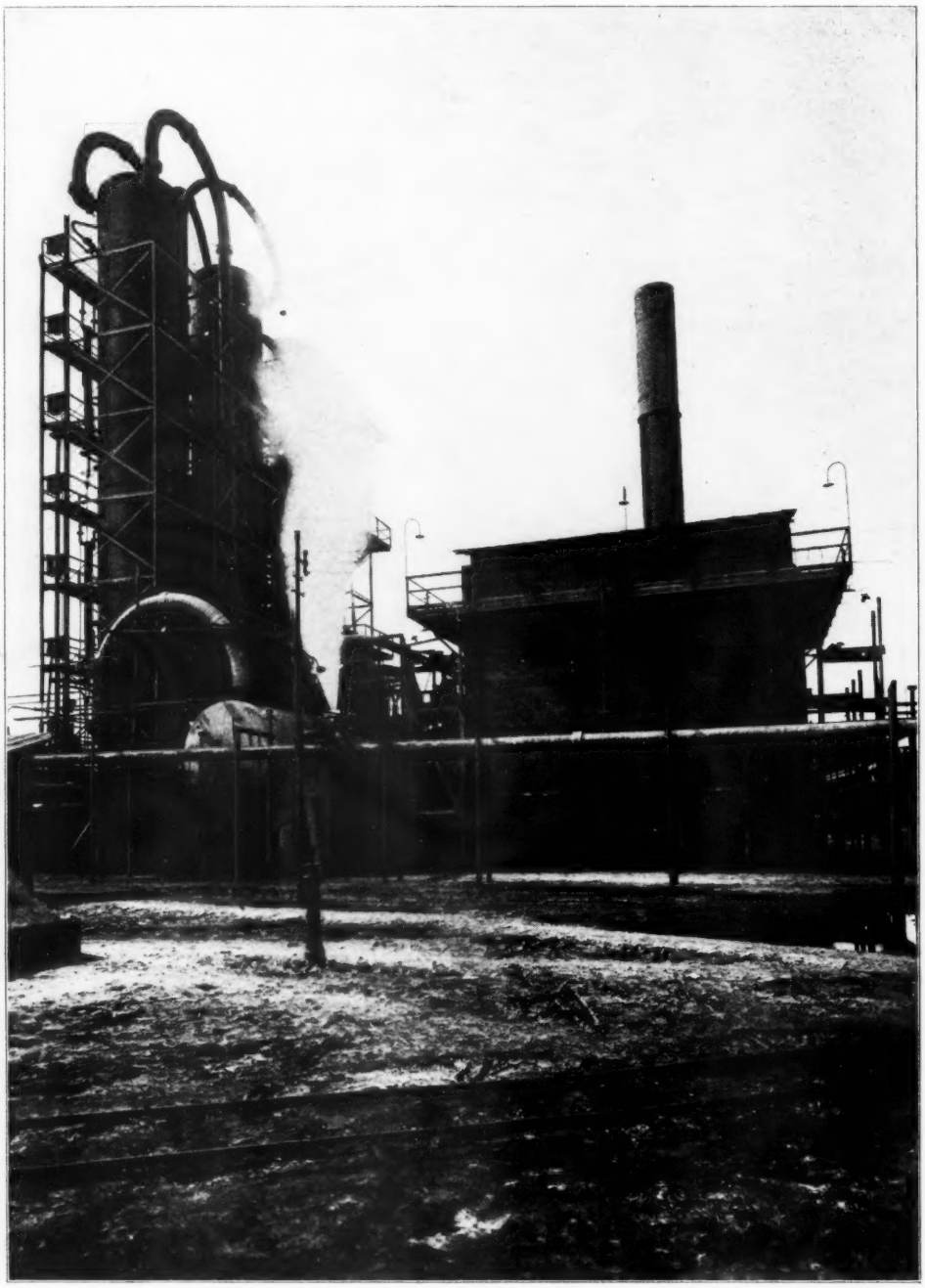

We offer our services to the Refining Division of the Petroleum Industry in the establishing and completion of a satisfactory program—both in the revision and expansion of present equipment and in the building of complete refineries.

e-in Roumania

THE Pipe Still Distillation Unit, shown on the opposite page, expresses the flexibility as well as the world-wide scope of McKee service to the Refining Industry. Two of these units were installed at the refineries operated by an English company which has been producing and refining in Roumanian territory for many years.

In addition to the obvious difficulty of construction work in a foreign land, the installation of these units presented several problems not ordinarily met with in refinery construction.

There are several available Roumanian crudes, each with a wide variation in characteristics; and it was necessary that each of these units should be designed to process all of these crudes.

Roumanian markets require many products to very close specifications. The lighter products, such as gasolines and naphthas, have much closer ranges and are more in number than similar products in this country.

While each unit was complete within itself, it was necessary that it should "tie-in" with existing equipment. This demanded complete co-ordination, both in design and fabrication, between American and European practice.

Owing to the wide variation of available crudes, some of the bottoms are processed for lubricating properties; while the bottoms of other crudes are sold as fuel oil.

One of these units has a capacity of 7,000 barrels per day, while the other has a capacity of 4,000 barrels. Both of the refineries are located at Ploesti, Roumania.

Altho most of the special equipment, such as heat exchangers, special pumps, temperature control apparatus, special valves and tubing, was shipped from the United States this work was erected, ready for operation, within twelve months after the signing of contracts.

In operation these units are producing the various products, of the required market specifications, with yields which equal or exceed the laboratory distillation of the crudes.

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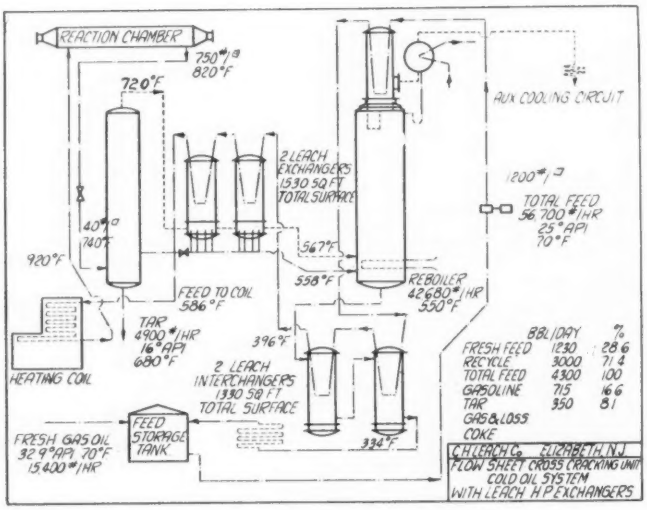

Fig. 3

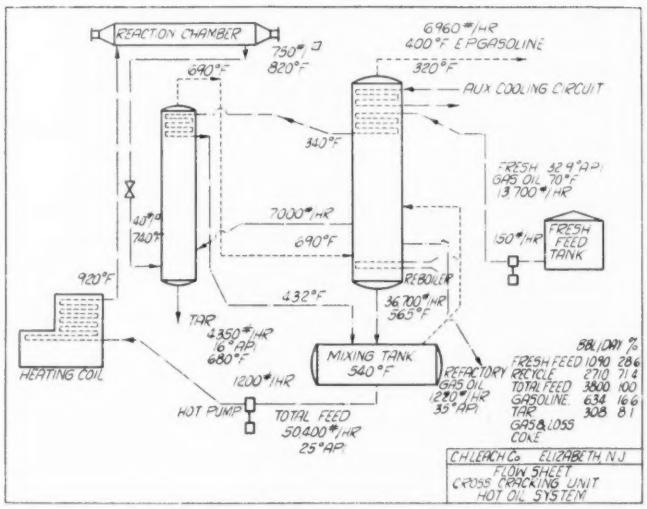

Fig. 4

at the low temperature prevailing at the top of the tower, the quantity of fresh feed available is insufficient to absorb this heat. It is necessary to circulate water or trimming oil as an auxiliary cooling medium. The heat absorbed by the water is wasted, and an additional expense for water is incurred.

Consideration of this alternate method emphasizes the advantage of removing excess heat from the vapor before entering the fractionating system and of utilizing the hot feed as the absorbing medium.

The possibilities which are opened up by the use of heat exchangers are illustrated by Figures 1 to 12. These flow sheets are based on actual operation of the more commonly used cracking processes. Predicted operation is indicated for the cases where the application of heat exchange is in advance of current practice. All data used has, however, been carefully verified by comparison with actual performance records.

Fig. 1 illustrates a conventional Cross cold system plant, having a capacity of 3280 barrels per day of total feed; 940 barrels per day fresh gas oil and 2340 barrels per day recycle stock. The feed is heated to 405 degrees F. before entering the cracking coils by passing through the trimming coils in the top of the bubble tower and the vaporizer.

Fig. 2 shows the same Cross cold system plant fitted with heat exchangers for the recovery of heat; 1—from the liquid recycle oil at the base of the tower; and, 2—from the recycle vapors ahead of the reflux tower. Instead of entering the cracking coils at 405 degrees F. the feed now enters the furnace at 586 degrees F. increasing the capacity of the plant from 3280 barrels per day to 4300 barrels per day.

The increased velocity of the oil through the cracking coils to the furnace decreases carbon deposition, reducing the upkeep on the coils and prolonging the possible length of the run. The load on the reflux tower is reduced as the vapors from the vaporizer, instead of proceeding at a temperature of 630 degrees F. to the tower, are first partially condensed by the feed to the coils, separating the heavier portion of the recycle stock.

Although the plant is handling 31 per cent more oil, the actual load on the furnace and bubble tower is lower than when running 3280 barrels per day.

While the exchanger investment is amply justified by the increased capacity of the cracking unit without additional fuel, labor or maintenance, greater yields of gasoline are also obtained due to the greater furnace area devoted to cracking and soaking and to the reduced load on the bubble tower giving better fractionation of the distillate.

Fig. 3 illustrates the same process with a more compact arrangement of the application of the exchangers whereby the trimming coils in the towers are eliminated. The reflux for the bubble tower and vaporizer is provided by a straight tube heat exchanger located outside, or on top of, the tower where it is easily accessible for cleaning.

Fig. 4 illustrates a conventional Cross hot system plant, having a capacity of 3800 barrels per day total feed. Of this, fresh feed is 1090 barrels per day, and recycle stock 2710 barrels per day. The fresh feed is

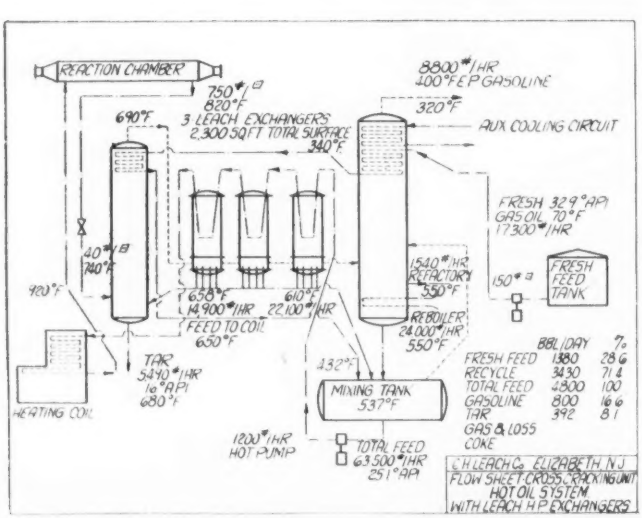

Fig. 5

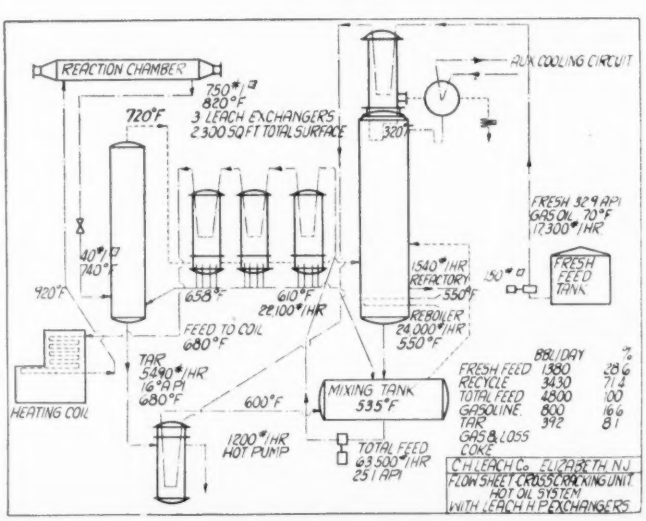

Fig. 6

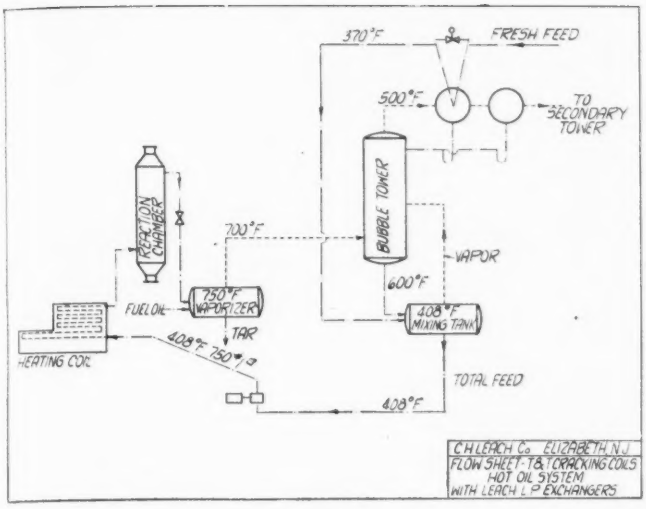

Fig. 7

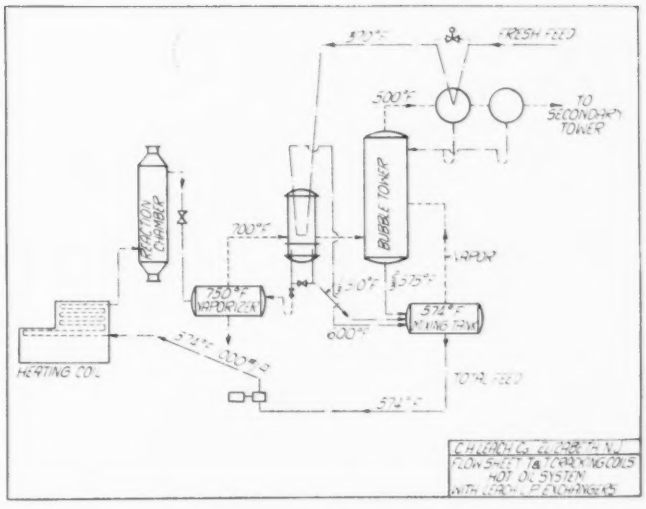

Fig. 8

passed through the trimming coils on the tops of the towers, where it is heated to 432 degrees F. and is then mixed with the hot recycle stock from the base of the reflux tower, proceeding to the coils at a temperature of 540 degrees F.

Fig. 5 shows the same Cross hot system plant fitted with high pressure vapor heat exchangers for the recovery of heat from the recycle vapor before entering the reflux tower. The feed now enters the cracking furnace at 650 degrees F. increasing the capacity of the plant from 3800 barrels per day to 4800 barrels per day.

Heat exchangers have increased the throughput more than 26 per cent without additional fuel or heat input to the furnace. The reflux tower has less load at the increased throughput than in the original plant, allowing better fractionation of the distillate and easier control. As before, comparatively cheap heat exchanger surface is substituted for expensive cracking coil surface, leaving to the cracking coil only the high temperature duty, not the preliminary heating.

Fig. 6 is an alternate exchanger application in which the trimming coils are not used. The vapor is permitted to leave the vaporizer hotter and the tar gravity is controlled by trapping the heavier fractions of the condensate from the exchangers back to the vaporizer. This arrangement has the advantage over that shown in Fig. 5 in that high temperature cooling medium is opposed to high temperature vapor, making possible a higher preheat at the furnace inlet. The mixing tank temperature is increased from 485 degrees to 535 degrees F. and the temperature of the oil entering the cracking coil from 650 degrees to 680 degrees F.

Fig. 7 illustrates conventional 1926 type Tube and Tank process plant. The feed enters the coils at 408 degrees F.

Fig. 8 is the same Tube and Tank process plant with one low pressure heat exchanger heating the fresh feed from 370 degrees to 600 degrees by means of the recycle vapor before entering the bubble tower. This is not a universally desirable application as the cooling effect in the heat exchanger is dependent only upon the quantity of fresh feed and does not parallel the increase or decrease in load on the bubble tower due to change in the recycle ratio.

Thus, if the recycle ratio were increased, the quantity of vapor going through the heat exchanger would be increased without a corresponding increase of condensation, and more load would be thrown on the bubble tower. However, the low pressure application shown in Fig. 8 has given remarkable results in the Link system, where the maximum amount of preheat in the fresh feed is required for flashing into the vaporizer.

Fig. 9 is the same Tube and Tank process with a high pressure vapor heat exchanger between the vaporizer and the bubble tower, heating the total feed to 638 degrees F.—64 degrees higher than can be secured by the arrangement shown in Fig. 8. This additional 64 degrees of preheat raises furnace capacity about 20 per cent and, on a plant of 10 cracking units, saves $250,000 per year over the maximum which could be saved by low pressure exchangers.

By using a high pressure exchanger on the discharge side of the pump,

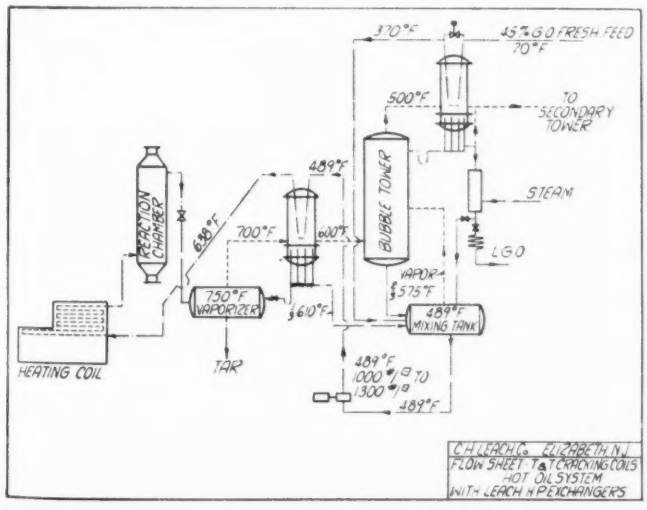

Fig. 9

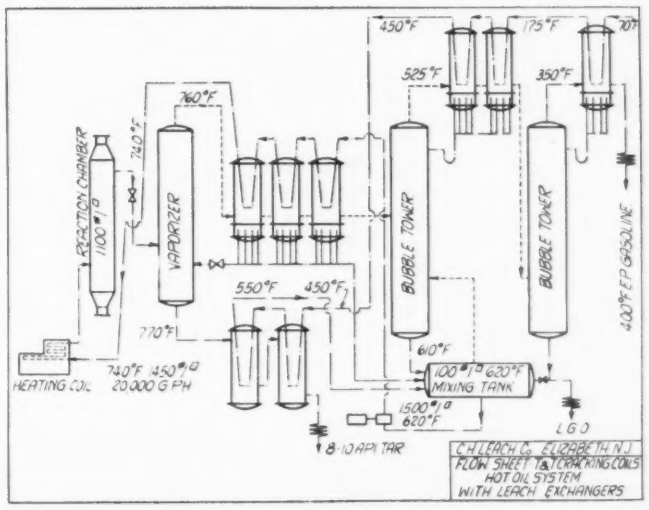

Fig. 10

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. . . Anyone is eligible except employees of Merco Nordstrom Valve Co. or affiliated companies.

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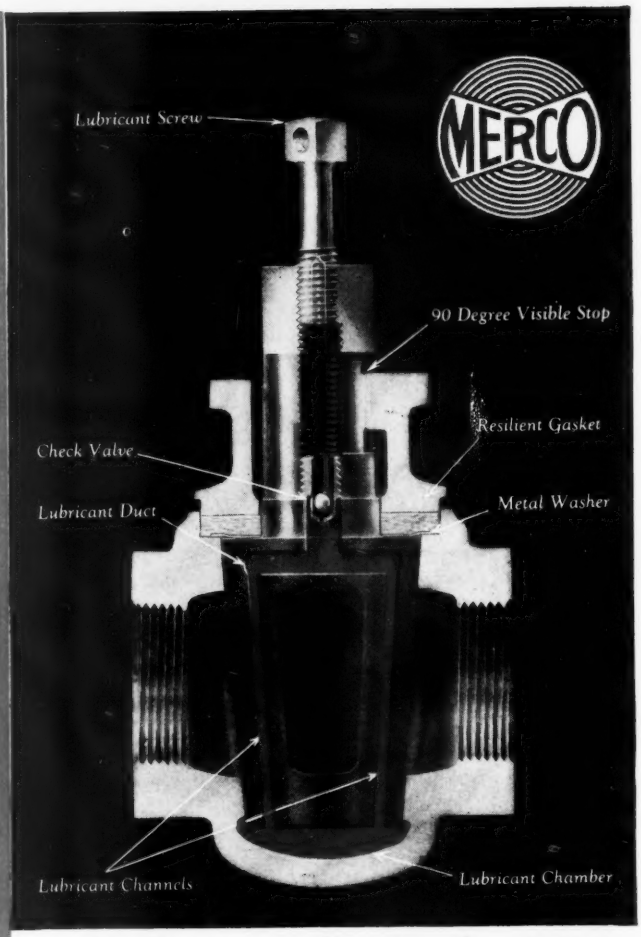

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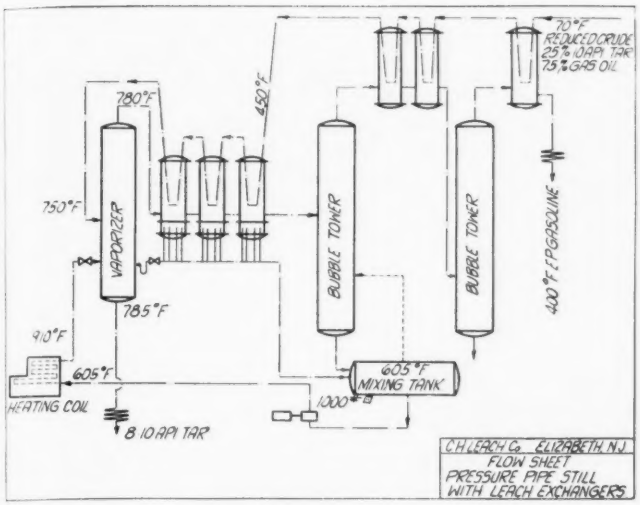


Fig. 11

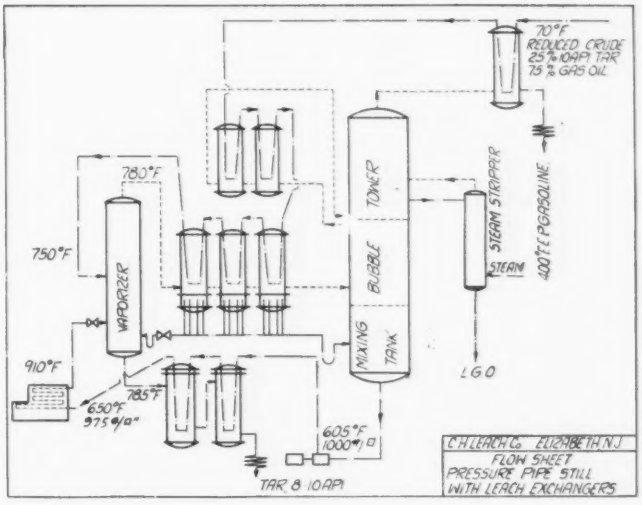


Fig. 12

it is possible to pass through it the total feed to the coils, giving a condensing capacity proportional to the actual load so that the load on the bubble tower is equalized for different recycle ratios. Due to the greater heat absorbing capacity of the total feed as compared to the fresh feed, the load on the tower is reduced and less auxiliary cooling medium is required for refluxing.

Also, this arrangement permits greater preheat under high recycle ratios, making possible a higher charging rate to the furnace and thus partially offsetting the decrease in the fresh feed rate due to the higher recycle ratio. Although the temperature of the feed is higher, the hot pump runs at a lower temperature.

Fig. 10 shows a modern, high capacity, high pressure cracking plant of 20,000 gallons per hour capacity. To insure high conversion per pass and small recycle ratios, a pressure of 1500 pounds per square inch is employed. By a complete application of low pressure and high pressure vapor heat exchangers and of tar coolers, the feed is preheated to 740 degrees F. before entering the furnace.

Notice that the fresh feed is used in the low pressure reflux condensers to the bubble towers and in the tar coolers, while the total feed from the mixing tank is pumped through the high pressure, high temperature vapor heat exchangers.

Fig. 11 shows a flashing system for the use of a reduced crude fresh feed. By means of high temperature heat exchangers, the reduced crude is preheated from 70 degrees F. to 750 degrees F. with heat that was formerly wasted. It is then charged into the vaporizer where it mixes with the vapors from the still at 910 degrees F.

A light cracking of the heavy ends takes place, and the entire fresh feed, with the exception of a cracked asphaltic residue, is vaporized and passes to the vapor heat exchangers with the recycle stock. In this way, the heavy asphaltic ends in the reduced crude, which would produce carbon in the coils, are separated without entering the cracking furnace, and the total feed to the coils is clean gas oil and recycle stock.

The use of a clean stock instead of the original reduced crude, increases the capacity over 60 per cent, and the length of the runs from 10 days to over 60 days at maximum conversion rate. All the operating possibilities of a high priced gas oil are secured with the cheapest cracking stock. It should be emphasized that it is the last 50 degrees added to the fresh feed which makes this method of operation possible.

If certain grades of reduced crude were to enter the vaporizer at 700 degrees F. instead of 750 degrees F. valuable cracking stock would be carried off in the tar.

Fig. 12 is the same type of process as shown in Fig. 11, with the use of a single bubble tower and high pressure exchangers to cool the tower. Liquid to liquid exchangers are also added to preheat the gas oil total feed by means of the tar from the vaporizer, raising the temperature of the feed entering the cracking furnace from 605 degrees F. to 650 degrees F. A steam stripper may be used if desired, but it is not necessary to remove the light gas oil as it can be successfully cracked in this process.

By a further application of heat exchangers, the waste heat from the cracking process can be used to strip the light ends from the crude. Crudes containing up to 35 per cent of naphtha can be processed in this manner. No fuel is burned except under the cracking coils.

The maximum recovery of heat on the conventional processes has been made possible only by the development of heat exchangers capable of withstanding temperatures above 750 degrees F. and, in many applications, liquid pressures up to 1500 pounds per square inch. (The division of surface between high and low pressure exchangers depends on the relative amounts of fresh feed and total feed. Where comparatively large volumes of low pressure feed are available, as in the flashing system shown by Fig. 11, it is possible to attain high final preheat when operating exchangers at moderate pressures. Plants having a high recycle ratio must operate the exchangers at cracking coil pressure). The conditions which must be met by such an exchanger are exacting.

Corrosion from sulfur at high temperatures must be met by special design so that parts such as gaskets, machined surfaces and joints of any kind are not exposed to the liquid distillate, which is more actively destructive than the vapors. Vapor velocities must also be limited to guard against excessive erosion in the presence of the corrosive elements. There is the danger of leakage of hot oil under high pressure. This means that the exchanger must be designed so that no possible creep or stretch of the material of construction can loosen the joints.

However, a sufficient number of successful applications have now been made to reassure the plant operator of the entire practicability of this type of heat exchange equipment when given individual engineering study. Many such exchangers have been in high pressure, high temperature service for over two years without requiring major repairs.

Furthermore, any apparatus operating on an expensive cracking plant must be easily and quickly accessible for inspection, cleaning and repair, in order not to interfere with plant operation. The heat exchangers must not take longer to service than the cracking coil on which they are operated. A modern 1000 square foot exchanger on a 10,000-barrel total feed per day cracking coil is opened, cleaned and reassembled by two men in less than four hours' working time.

Less time would be needed if four men were used, but as the coils must be off stream several hours for routine inspection, no useful end would be gained.

How to Keep White Painted Tanks White And Glossy to Reduce Evaporation

By H. A. Reddy

MUCH has been written regarding the effect of color on evaporation losses on tank storage of crudes and refined distillates. The petroleum world fully realizes the value of white and light tint coatings in this connection.

The maintenance of initial whiteness and color brilliance over extended periods of time has always been a problem to the paint manufacturer.

Initial and continued gloss has largely been a function of the vehicle or liquids in any paint product. However, it has been impossible to maintain high gloss with present day durable vehicles.

Later day researches tend to show that initial whiteness and minimized fading in tints can be accomplished through another agency; viz: Self cleaning by "controlled chalking" wherein inert extender plays a prominent part.

In the early days of paint manufacture, inert extenders achieved a very unenviable reputation among consumers because they were incorporated in high percentages in paint products by irresponsible manufacturers as "make weights" and "cheapening agents" at the expense of durability.

When ready mixed paint began to be popularly accepted, however, manufacturers soon found that a percentage of extender enhanced the keeping qualities in the container and as such became a valuable ingredient.

Controversy next arose as to what percentage of extender could be legitimately incorporated to take care of the keeping qualities. Exposure tests designed to determine this point soon began to indicate a durability value where inert extender was used.

For a long time technicians ascribed this durability factor to improved anchorage due to fibrous structure, saw tooth edges, irregular faces and sizes of the particles creating a cementing action.

The very fact that the theory has been advanced is at least some evidence indicating that inert, when used in limited quantities, does not have a harmful effect but, on the contrary, has a favorable effect on the durability of these paints.

Mr. Reddy was educated in the middle west, and graduated from North Dakota Agricultural College, where he specialized in paint chemistry, and carried on graduate work under the late E. F. Ladd. Subsequently he was connected with John Lucas & Co. as a paint chemist, and for the last 12 years has been associated with E. I. du Pont de Nemours & Co. During part of this time, he was connected with the technical laboratories, and was directly in charge of control of raw materials and finished products, and certain development and research work.

More recently, he has been active as a technical engineer connected with the petroleum sales department of the du Pont company. This latter work has involved very extensive traveling, taking him to all of the oil fields in the United States, and to the principal refining centers.

This direct contact with the problems of the petroleum industry has enabled him to acquire a knowledge of the unusual and severe exposure conditions to which protective coatings are subjected in the petroleum industry.

Through research work on prepared paints of both the lead-zinc and lithopone-zinc type, positive information has accumulated showing that a certain amount of inert definitely favors improved durability in paint films. The reason, however, is not in accordance with the old time theory.

Oxidation

A drying oil film on continued exposure tends to change in relative dimensions, due partially to the expansion and contraction of the material to which it is applied and partially to the oxidation of the oil. Eventually this film becomes hard and brittle. This is somewhat accentuated by the action of sunlight, which, however, in a pigmented film is confined largely to the surface.

Ultra Violet

The sunlight, however, plays still another important part, that is, it definitely tends to break down that portion of the film exposed directly to ultra-violet light. Inert, of course, offers no resistance to ultra-violet light, but it does play a part in that in effect it reduces the bad effects of dimensional changes in the hardening oil film.

Cracking

Pigments of the so-called active type—lithopone, white lead, zinc oxide, etc.—are for the most part non-effective in offsetting the cracking due to the hardened condition of the film on setting. It has been found, however, that inert pigments such as asbestine and silica do have such an effect. Moreover, titanium oxide seems to belong to the same class.

Its judicious use, therefore, gives us an additional weapon in that it not only minimizes cracking, but it also furnishes hiding power and ultra-violet protection to the film.

Chalking

Titanium oxide, however, if used in excess will chalk excessively. This chalking is shallow due to the high ultra-violet opacity of titanium oxide.

As a result, the chalking titanium oxide film is very clean.

White lead and lithopone on chalking—primarily because the sunlight penetrates beneath the pigment particle and destroys the oil at that point, thus forming deeper pits—leaves a surface which tends to collect more dirt than does titanium oxide.

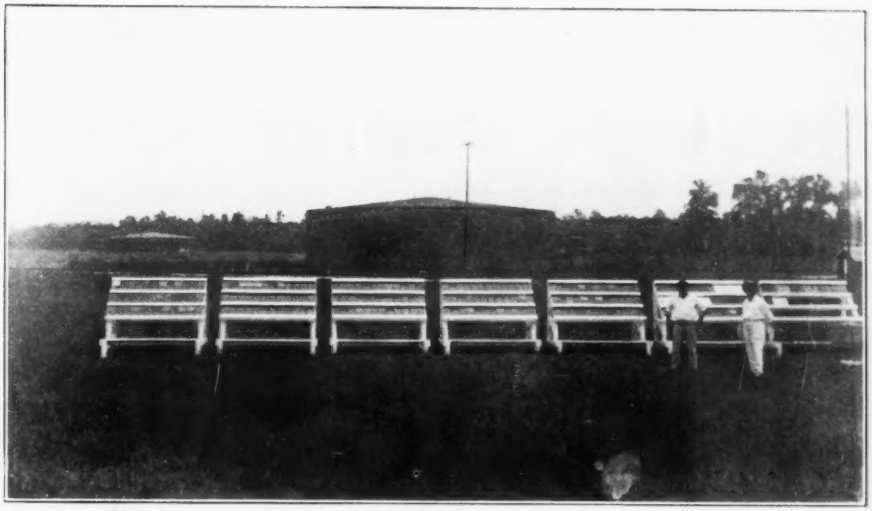
Self Cleaning Films

The relatively high ultra-violet opacity of lithopone as compared with white lead accounts to some extent for the greater cleanliness of the chalking lithopone surface as compared to a chalking white lead surface. The lead soaps present in the lead film also tend to increase the dirt collection of the lead paint.

Another point which further substantiates this theory is that titanium oxide chalks practically as rapidly on northern exposures as it does on the southern because titanium oxide chalking is not dependent directly on the action of sunlight. One would expect that titanium oxide would not discriminate in this manner as does lithopone and white lead.

Titanium oxide, however, chalks excessively when used in straight titanium/zinc oxide/inert outside paint. Inert would be even worse. Nevertheless, the presence of an inert material is necessary in a paint which tends to grow hard on continued exposure. Lead, titanium oxide, lithopone and inerts all produce a chalking film under the influence of an ultra-violet light.

Zinc, on the other hand, produces a brittle, enamel-like film which fails by cracking, blistering and peeling when exposed under parallel conditions.



Paint tests on a tank farm. Metal protective test fence at Houston, Tex.

Comparative Results

Our studies with inert extender included lead-zinc, lithopone-zinc and titanium-zinc combinations. The compilation of results obtained showed a consistent relationship between test fence panels exposed vertically and at an angle of 45 degrees. These results were also in accord with those obtained by accelerated testing. Finally, field application on a commercial scale are proving the accuracy of data obtained from laboratory research, viz:

Inert extender when blended in proper balance with selected prime pigments:

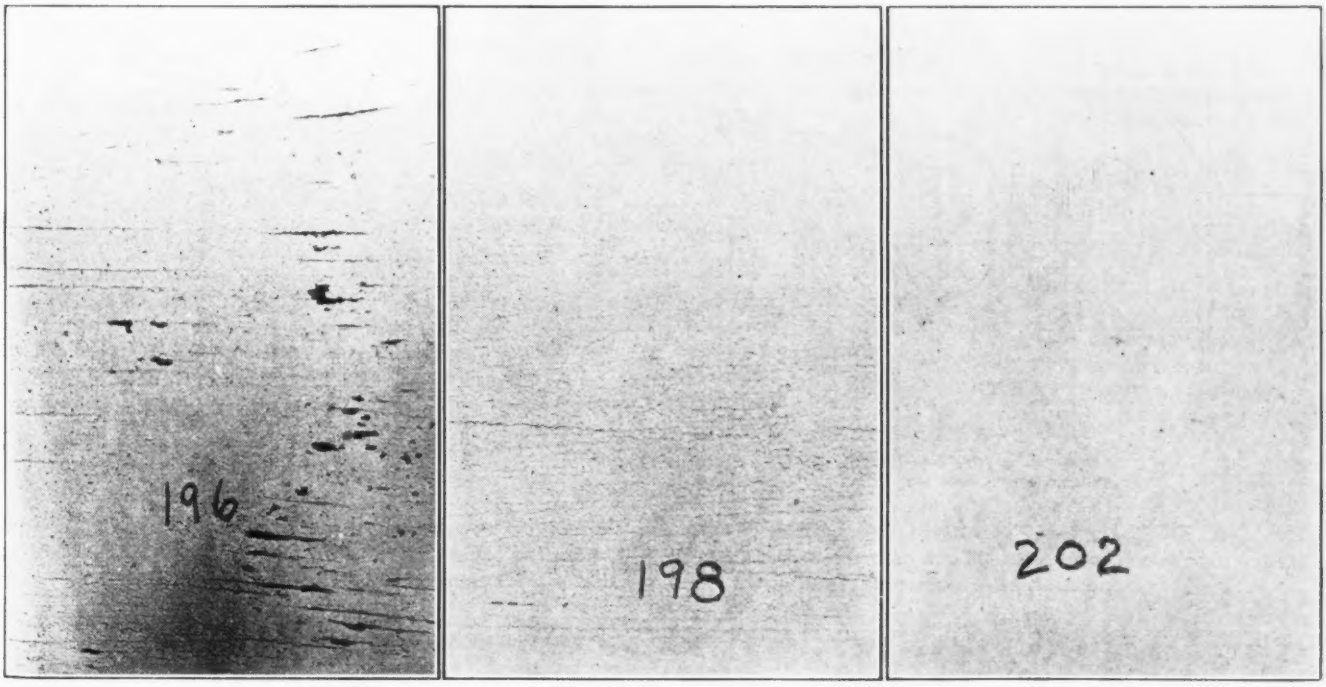
(1) Extends film durability.

(2) Promotes retention of original cleanliness and brilliance.

(3) Eliminates peeling and blistering, returning desirable surface for repainting.

Summing up the situation, paints white in color are the best reflectors of heat and reduce evaporation losses to the lowest percentages. Continued whiteness over long periods of time is best maintained though self cleaning by "controlled chalking." Lead-zinc-inert combinations while chalking in nature, darken by dirt collection and chemical action.

Titanium/zinc combinations usually chalk too fast resulting in impaired protection or early failure.



Effect of inert extender on lithopone type paints. From left to right, 196, no inert; 198, 10 per cent inert; 202, 25 per cent inert

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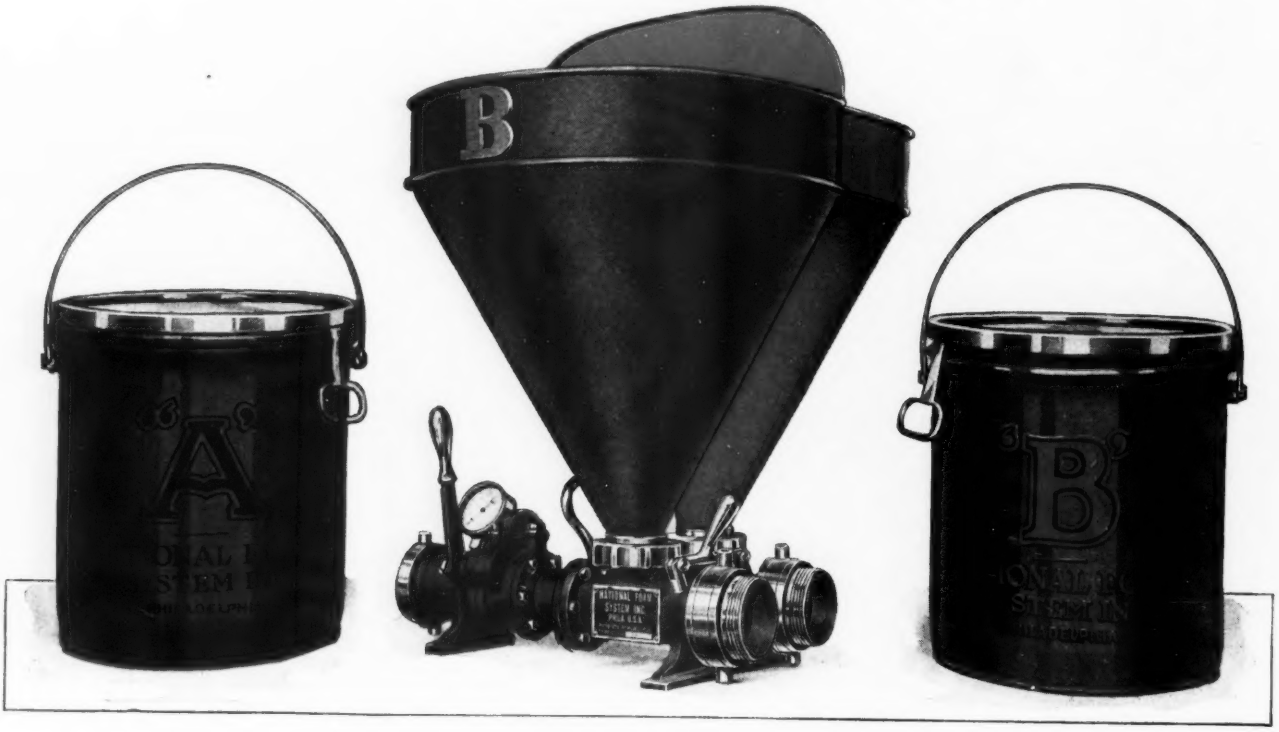

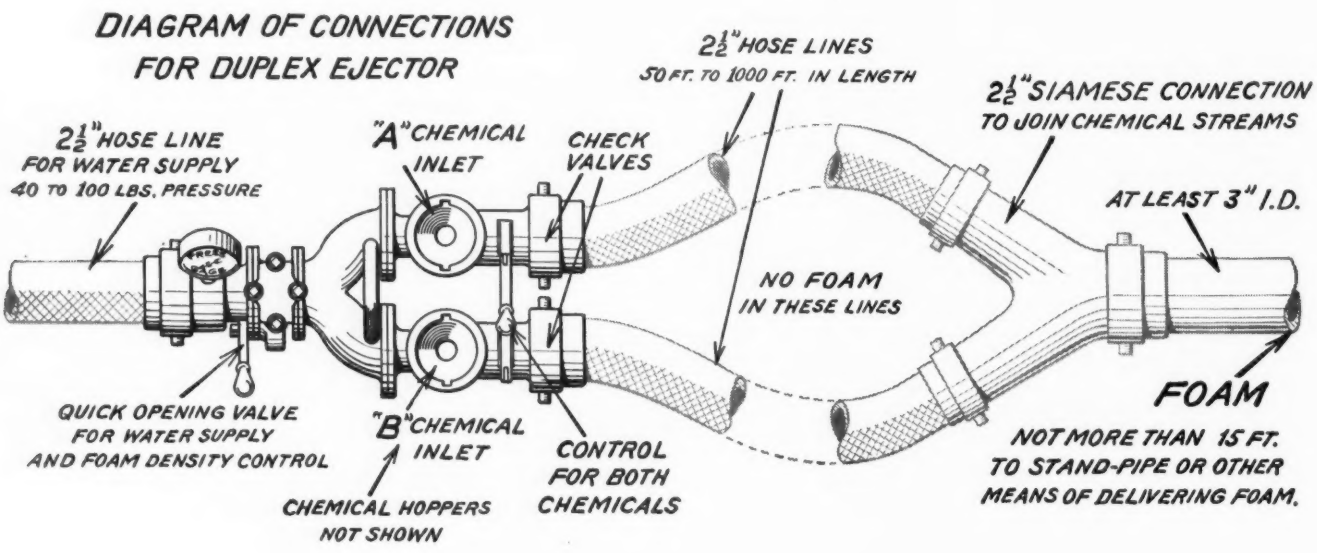

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Fixed Gas from Gyro Process Will Yield Highly Anti-Knock Motor Fuel

By C. R. Wagner*

(Presented before Western Petroleum Refiners Association, Tulsa, Oct. 28, 29)

INTEREST in vapor phase cracking is increasing rapidly in the industry because of the character of the products produced. The motor fuel fractions offer a fair substitute for motor benzol for blending with ordinary gasoline in the making of premium anti-knock fuels. For example, a refiner operating on an average crude containing 30 per cent gasoline can market his entire product as a premium fuel, if he charges his topped crude to a vapor phase cracking plant.

For each 1000 barrels of crude handled he has added to his plant revenues at least $504, half of which is collected on what would otherwise be ordinary motor gasoline.

The gases from a vapor phase cracking unit offer unusual opportunities to the refiner. Already these gases are being used in large quantities for the manufacture of glycol, acetone, alcohols and for gas enrichment. The dry gas has a fuel value of about 1700 B.t.u. per cubic foot which makes it a particularly valuable product for enrichment purposes.

Due to its high olefin content it acts also as a carrier for naphthalene and thus assists in one of the most serious problems confronting the gas industry.

With little additional cost it would be possible to separate fairly pure ethylene, propylene or butylene from the gas. The commercial possibilities in marketing these products are enormous. It seems probable, however, that the most profitable utilization of this gas lies in its conversion into motor fuel.

It has been discovered that over half of the dry gas produced can be converted into motor fuel distillate of even higher anti-knock properties than the original product of the vapor phase cracking operation. This distillate is very rich in compounds boiling between 150 and 300 degrees Fahr., lends itself readily to treatment and yields a stable motor fuel. It appears to have particularly valuable possibilities in the field of aviation fuels.

Among the first to offer to the public a vapor phase cracking process which could compete with liquid phase cracking methods was the Gyro Process Co. By reference to the accompanying flow sheet the method of operation and the salient features of the process become evident. The highest pressure used in the system is about 100 pounds gage and this is on the cold oil spray to the arrester.

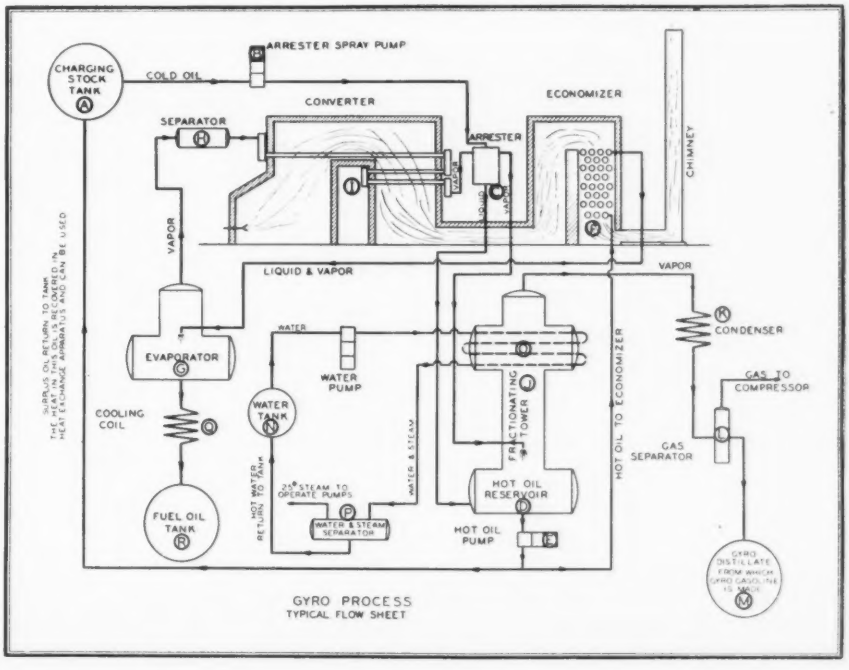
The evaporator carries the highest vapor pressure of the system and this ordinarily runs between 10 and 20 pounds gage. The converter, to which are localized all temperatures above 750 degrees Fahr. used throughout the entire apparatus, can contain not more than 10 gallons of oil as vapor at any one instant.

Owing to the method used in delivering vapors to the converter it is possible to handle any grade of oil as charging stock. Fractions boiling within the range of the motor fuel desired are eliminated at once and by control of the oil line temperature and rate of steam flow into the evaporator as much or as little of the charging stock as desired may be eliminated as fuel oil.

Charging stock from the tank (A) is delivered by means of the pump (B) to the arrester (C) spray nozzles where the vapors leaving the converter (I) are reduced in temperature from about 1100 to 600 degrees Fahr. The liquid from the arrester which consists of residuum from the charging stock plus any condensed material from the converter passes by gravity to the hot oil reservoir (D).

The vapors from the arrester, which consist of vaporized portions of the charging stock plus uncondensed products of the converter, pass to the fractionating tower (J). This fractionating tower is so designed that the distillate which is condensed from the vapors leaving the top of it will have a boiling range commensurate with the motor fuel desired. This boiling range is controlled by means of the refluxer (O) which may be arranged, as shown on the flow sheet, for the production of low pressure steam.

The quantity of steam produced in this manner is more than enough to operate all of the pumps used in the process and to supply all of the required process steam. The gas from the gas separator (L) is led to a compressor for the recovery of its liquefiable motor fuel content by any suitable method.



GYRO PROCESS
TYPICAL FLOW SHEET

*Assistant Chief Chemist, Pure Oil Co.

We are pleased to announce that the Atlantic Refining Company has taken a license under our patents and will immediately erect polymerizers having a Vapor Phase Refining capacity of 10,000 barrels of cracked gasoline per day.

The Gray Processes Corporation

961 Frelinghuysen Avenue

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The hot oil reservoir (D) acts as a collector for all of the oil which enters the system which has not yet been converted into motor fuel or fixed gas. The hot oil pump (E) is controlled as to speed so that it will maintain a constant liquid level in the hot oil reservoir (D). The quantity of this hot oil delivered to the economizer (F) is regulated by an automatic rate of flow controller.

This rate of flow is so maintained that the converter is constantly supplied with the correct quantity of vapor. The balance of this hot oil is returned to the charging stock tank (A) through either heat exchangers or coolers.

The portion of the hot oil which passes through the economizer leaves the economizer (F) at a temperature of about 700 degrees Fahr. and enters the evaporator (G). Here the fuel oil drops out as residuum and is removed from the system through the cooling coil (Q) to the fuel oil tank (R). Superheated steam is introduced into the system through perforated coils in the bottom of this evaporator in quantity not to exceed 3 per cent by weight of the vapors produced.

THE vapors and steam leaving the top of the evaporator pass through separator (H) which removes particles of entrained liquid. From the separator the vapors pass through a series of preheater or drying tubes in the bottom part of the converter (I) to the inlet of the converter.

In these drying tubes the vapors are given about 30 to 50 degrees Fahr. superheat which suffices to remove the white fog that always accompanies any stream of saturated gas oil vapor. These fog particles are in reality tiny drops of liquid oil and unless removed cause some difficulty in the operation of the converter.

In passing through the converter the temperature of the vapors is increased to approximately 1100 degrees Fahr. and the conversion to lighter hydrocarbons occurs at this point. In this converter the vapors are distributed by means of the inlet header and passed through a number of tubes in parallel, the tubes containing catalytic cores. From the outlet of the converter (I) the vapors pass into the arrester (C) which was described above.

In developing this process it was necessary to carry on considerable fundamental research work and for this purpose a small unit was developed which would handle about 10 barrels of charging stock per day. This unit consists of a cross-section of the commercial installations and therefore gives results which can be interpreted in terms of large scale operation.

Quite a variety of charging stocks have been run in an endeavor to learn something of the behavior of these oils under the conditions found in vapor phase cracking. Although these runs were of short duration (24 to 48 hours) it was discovered early in the work that they were readily duplicated and that runs of longer duration added little of value to the results obtained in the short runs.

In the accompanying table are given results of several runs on various grades of charging stock. Comparison may also be made between different throughputs and lengths of converter tube in the case of Cabin Creek gas oil.

From the data given in this table it appears that the process is applicable to a wide variety of charging stocks. Inspection of the distillates produced from these various charging stocks shows a remarkable similarity, if they are all rerun to the same boiling point specification. Analyses made of the gases produced also indicate that the character of the charging stock has little to do with their composition.

It stands to reason from a study of the cracking reaction that a light charging stock should yield a higher percentage of distillate than a heavy one, since decomposition of the molecules needs to be less profound. In many cases, however, the yield of distillate will be determined by the quality of fuel oil which must be produced.

At this point the true flexibility of the process becomes evident. Even a casual inspection reveals that we have here four separate operations involved, each one an individual problem, but all co-ordinated into one process. The economizer and evaporator constitute an ordinary tube still unit for the production of vapors and fuel oil residue.

To increase fuel viscosity it is necessary to increase the quantity of steam, or in some other way to increase the percentage vaporized without cracking the residue. To decrease fuel viscosity one may increase fuel production, or the oil line temperature may be raised enough to cause mild cracking.

IF CAREFULLY done, this latter method will result in decreasing fuel percentage as well as viscosity. By the same token it is possible to operate so as to make an asphalt residue as a final product instead of a fuel oil.

The second operation involved is the cracking of the vapors in the converter. As can readily be seen, this operation may be varied at will so as to secure the desired products and yields. This constitutes the only special piece of equipment in the Gyro process, and represents less than 30 per cent of the total cost of the installation.

The converter has a specially designed furnace intended to utilize in the most efficient manner the radiant heat generated by combustion of the fuel. Care is taken that the rate of heat absorption by the vapors in their passage through the converter is proportioned to the needs of the reaction. Thus in the first few feet heat is absorbed at a rate in excess of 75,000 B.t.u. per square foot per hour, but farther on this rate is dropped to that necessary to maintain the temperature of reaction.

In the beginning of the development work when recirculation of flue gas was employed, difficulty was encountered in utilizing all of the waste heat in the flue gases leaving the converter. With the improvements in furnace design mentioned above, the same heating is now done with five feet of tubing which formerly required 10 feet and the waste gases are insufficient in quantity to vaporize the gas oil required by the process.

THE third unit in the process is the fractionating apparatus. For this purpose ordinary refinery equipment may be used. The heat abstracted in producing reflux has been utilized by converting the refluxer into a low pressure steam boiler.

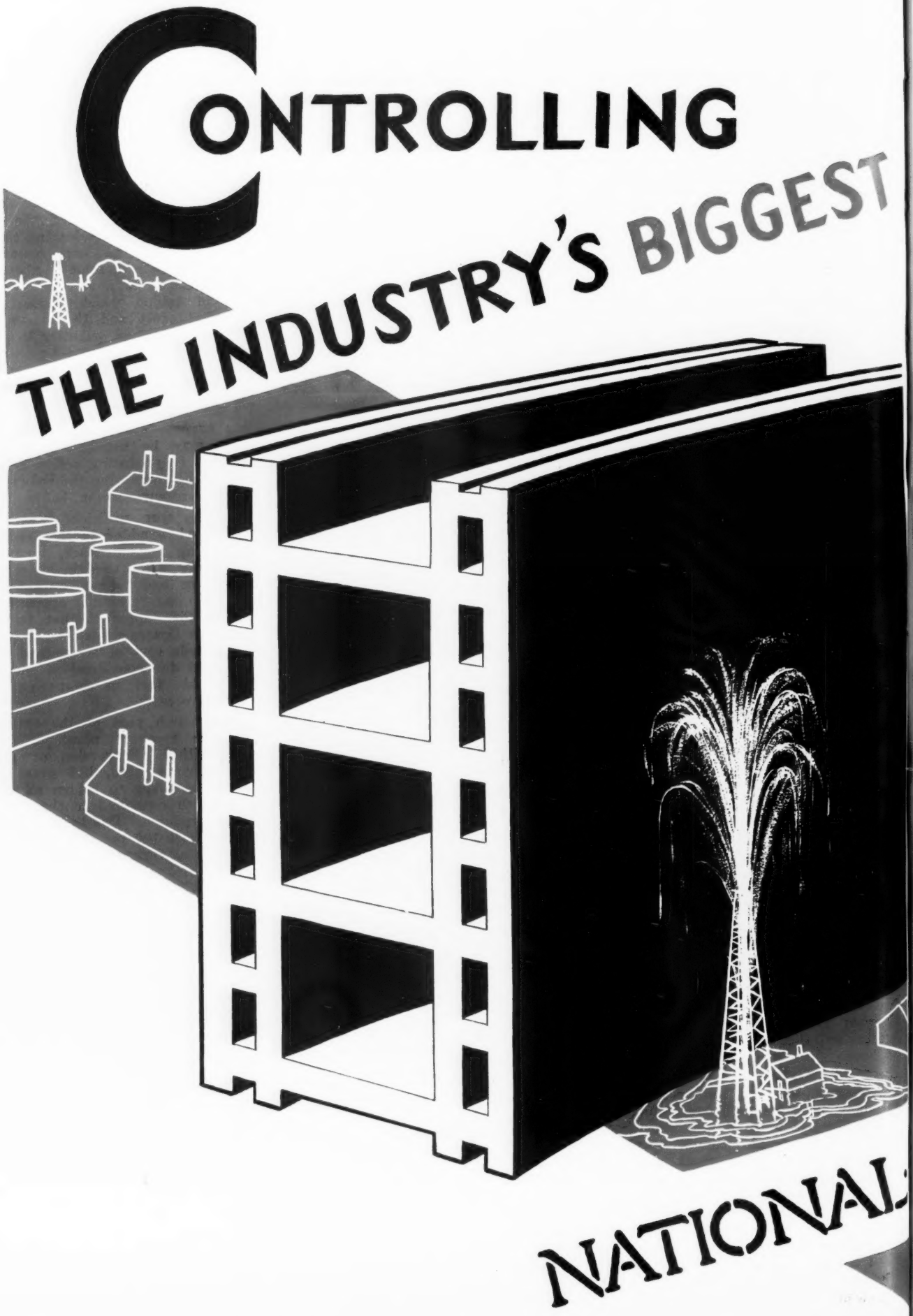
In this way sufficient heat is obtained, when added to that recovered in cooling recycle stock, to produce all of the steam used in all pumping operations and to evaporate the distillate in the rerunning operation. It is therefore apparent that fuel consumption figures quoted for this process include cost of steam and rerunning and due consideration should be given this fact in comparing with other processes.

The fourth part of the system is the gas recovery plant. For this work either compression or absorption may be used, but great care should be taken to return all of the product so recovered to the raw distillate produced. Due to the fact that it is almost 100 per cent unsaturated it possesses very high antiknock value, and it also requires treatment similar to that given the remainder of the distillate in order to produce a suitable motor fuel.

Since the fixed gas comes off the look box at almost atmospheric pressure it is saturated with motor fuel fractions and may run as high as five gallons per 1000 cubic feet. Approximately twenty per cent of the distillate made therefore is recovered from the gas.

A feature of low pressure vapor phase cracking which appeals to the refiner who runs a high sulfur crude is the desulfurizing character of the reaction and the freedom from worry over corrosion problems. When cracking a high sulfur charging stock the distillate obtained will have a sulfur content of about 50 to 60 per cent that obtained by producing the same boiling point distillate by liquid phase cracking.

This appears to be due to the fact that a much higher percentage of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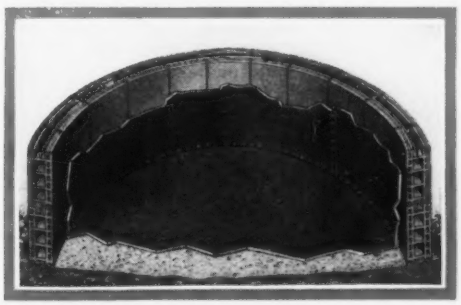
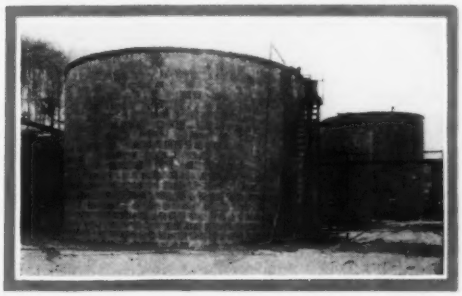


Cross-section showing two courses Segmen-Tile. Note curvature in wall. Ends are cut to any radius depending on diameter of tank.



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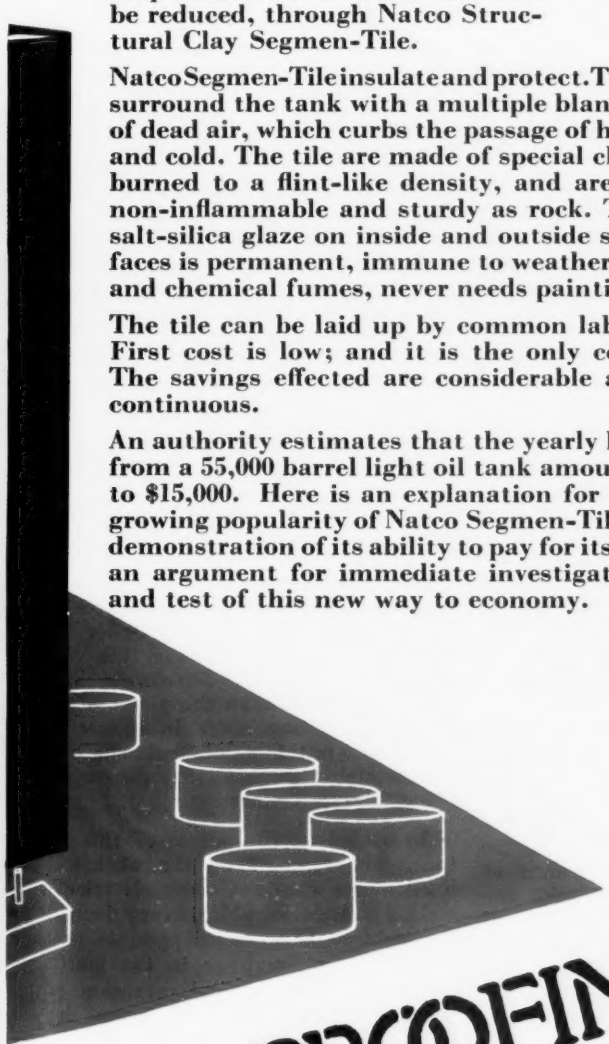

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hydrogen sulfide is split off which appears in the fixed gas. It would seem probable at first that this fact would lead to increased corrosion problems, but examination of the temperature gradient through the process reveals some interesting facts.

It will be noted that in the economizer and evaporator the temperature is low enough to avoid material cracking and the consequent production of large amounts of H_2S. Corrosion in this part of the apparatus will not be great, therefore, especially since all of the light fractions have been removed and the entire body of oil passing through the economizer has been held for some time at temperatures between 475 and 550 degrees Fahr.

In the converter the temperatures are right and sufficient H_2S is present to cause corrosion at a very rapid rate. The use of calorized steel or stainless steel parts, made necessary by the very high temperatures and oxidizing conditions in the furnace gases, effectively prevents excessive corrosion in this part of the equipment. Since the temperature is reduced to 600 degrees Fahr. or less in the arrester and is maintained below that figure for the remainder of the apparatus, little corrosion is encountered in vapor lines and towers. As is well known, it requires temperatures in excess of 600 degrees Fahr. or high velocities at lower temperatures to cause continued corrosion by hydrogen sulfide.

In the first place it was the quality of the product alone that caused the refiner to turn to vapor phase cracking methods. It is therefore with considerable gratification that he can now reflect that he has a process which not only produces that same quality of product, but in addition produces it in quantities and at costs which compare favorably with the production costs of liquid phase cracked gasoline.

Safety First Consideration In Heavy Plate Welding

By F. G. Sherbondy*

THE first and most important requirement of a welded pressure vessel should be that it is safe at the temperature and pressure at which the vessel is to be operated. At this stage of the development of welding practice the matter of safety is more than difference in initial cost.

Possibly the worst blunder some plate fabricators make in going into the welding of heavy vessels is to assume that this class of construction can be built under the same methods and specifications as are employed in the case of plate up to and including ⅝-inch in thickness.

Some years ago when our company undertook to weld heavy plate experimentally, we discovered that there were a good many difficulties encountered which had not been experienced in the welding of material ⅝ of an inch thick or less. This set of conditions led to an appropriation for a laboratory and engineering study of the whole subject of heavy plates fabrication by welding.

One of the first things we found was that we could not rely for the quality of our work upon the skill or good intent of the welding operators. This was not due to any lack of morale on the part of the operators employed but was simply due to the fact that we could not afford to allow the human equation to enter into the fabrication of vessels whose failure might result in death and great property destruction.

We found that no precise and invariable methods specifications had been developed which did effectively bring under control all of the variables which entered into the final result, namely, the production of a safe pressure vessel.

Our engineers and laboratory force proceeded to establish all of the variables which entered into the final result. The list of these variables included such items as ductility of the metal in the weld, the presence of oxides and nitrides in the weld, the welding heat used, the sequence of the welding operation, the preparation of the plates for welding, the fitting up of the plates preparatory to welding, the carbon content of the plates used, etc.

Having established definitely what the variables were, our engineers and research men then proceeded to establish the limits of variation in each case. After that, the problem became one of reducing the limits of variation and finding methods of controlling the variation in each case.

During the course of these investigations, hundreds of welds were made and the data on physical behavior recorded.

Probably the most interesting phase of the studies from the scientific point of view was that which related to residual strain in the weld. It had been the custom among several of the manufacturers of unfired pressure vessels made of heavy plate to anneal the vessel in some cases several times during the progress of the welding and after it was completed. Our investigations on this point were carried on in a very complete way.

We discovered that by controlling all of the variables which entered into the final result that it became quite unnecessary to anneal vessels having a plate thickness up to 1½ inches. We are now carrying the investigation on into plate thicker than 1½ inches and there seems to be a strong probability that it will become necessary to anneal vessels of this thickness.

The standard by which to compare the electric arc-weld pressure vessel, of course, was the behavior of the vessels made by the hammer welding process. This process has been known and used for many years in the fabrication of such vessels, and it seemed only logical to utilize the performance of such vessels as a gauge to measure the accomplishments of our technical forces who had been working on the problem of manufacturing the vessels by electric arc welding.

We found that welds made in pressure vessels under the procedure control established by our engineers and laboratory men could be relied upon to be not less than 25 per cent.

Under accelerated corrosion tests the welds did not corrode any faster than the original plate. Under the effect of high temperature, the electric welds did not deteriorate with greater rapidity than the plate. There is an interesting story in connection with this latter point, but space is not available to detail the discoveries made in this connection.

As stated at the outset of this article, the object of all the work outlined above was to produce electrically welded vessels in which every inch of the weld could be relied upon to have predetermined qualities in the matter of tension, bending and corrosion resistance. Our procedure control has consistently yielded this result. Yet our engineers are continually testing experimental vessels and reproductions of parts of large vessels to check the results of the procedure control.

The main problem of building arc welded vessels which are safe and reliable has been solved. The next problem, and the problem upon which our forces are now concentrating their efforts is one of accomplishing this result at steadily decreasing costs.

*Treasurer, the Biggs Boiler Works, Akron, O.

And Now an Automatic Control Method For Cracking Still Stabilizers

By M. J. Bradley*

MEN who are familiar with the operating of steam stabilizers regard them as being very difficult to control automatically, because there are so many variable factors that influence the temperature.

In the first place, the number of cracking units that furnish gas to the stabilizer varies from day to day.

Then, gas charging pumps will slip, and steam pressure will vary. The latent heat of steam, and the heat of vaporization of liquids, will cause trouble.

The development of a machine that will maintain the proper temperature in the face of these difficulties, has been a long and tedious task. It has been conquered, however, and the controller has been operating in a highly satisfactory fashion on a stabilizer for several months.

The stabilizer consists of a fractionation tower into which the non-condensible gases from a battery of 28 cracking units are pumped. The number of units in service, and hence the volume of gases, varies.

A series of trays in the tower allows for the vaporization and condensation of the hydrocarbons. In the bottom of the tower is a mixture of liquids whose temperature must be held highly constant by means of a steam line. Fluctuations in steam pressure and in the pressure and amount of gases, are the principal difficulties.

The principal item in the equipment for overcoming these difficulties is a recording, controlling potentiometer pyrometer, fitted with a special device called an anticipator, which actually anticipates temperature conditions in the liquid. This controller moves the steam valve by means of a double motored, 3-position balancing valve drive. The rest of the equipment consists of thermocouple, relays, etc.

When the temperature of the liquid starts to depart from the control figure of (in this case) 280 F., the controller instantly goes into action. With a single motion it moves the valve in the proper direction, and starts an open clutch to rotating, in anticipation of the need of a further adjustment of the valve.

If the first adjustment turns out to be enough, the clutch stops. But if the temperature is still going away from the control figure, at the end of a predetermined amount of time, the controller shifts the normal position of the valve.

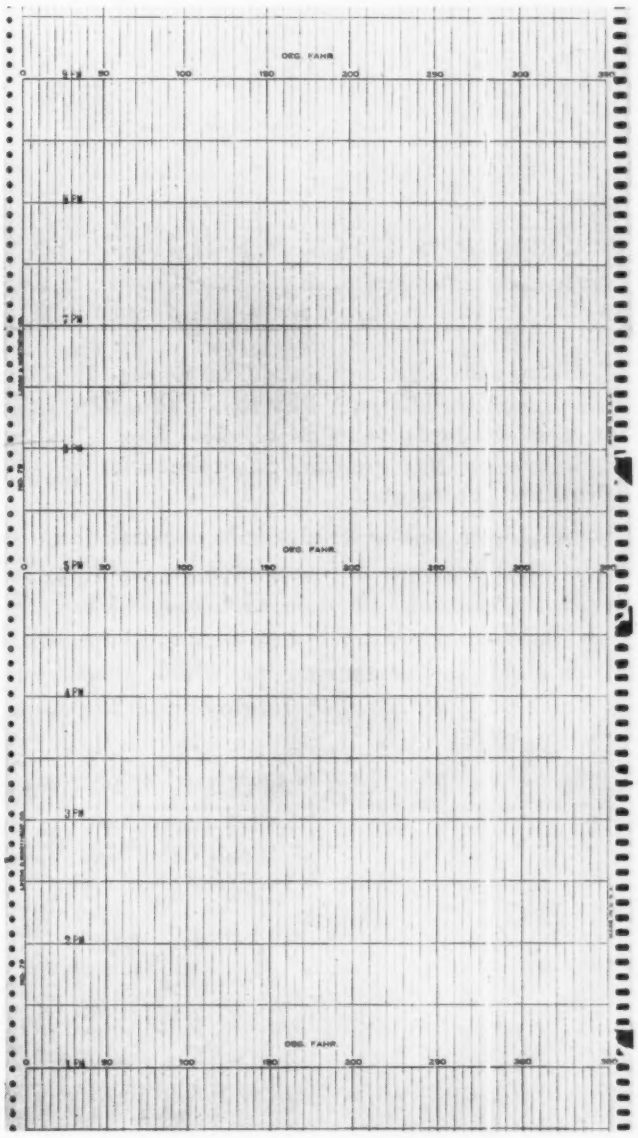
This somewhat strenuous treatment always turns the trend of the temperature within a few seconds. Just as soon as the trend is toward the control figure, the controller automatically anticipates the danger of overshooting, and shifts the normal position of the valve again.

Rapidly and smoothly it runs the temperature back to the control figure, and holds it there until another change in operating conditions necessitates action. There is no hunting or overshooting—no running back and forth across the control line in a series of swings—because the controller finds the correct normal setting for the valve, and changes it when and as necessary.

Operators never have to touch the control, except for routine maintenance such as oiling.

Probably the best indication of the success of this control is the fact that it never lets the temperature get more than 3 degrees from the control figure, and even that departure is always corrected in five minutes or less. For hours at a time the temperature is held within 1 or 2 degrees of the ideal.

This would seem to be a condition that is very desirable. In one case it has meant the saving of $300 worth of butane per day. In any event, maximum yield is greatly improved, and the same apparatus can apparently be applied to many temperature control problems.



A typical record of temperature conditions in a steam stabilizer under the automatic, anticipating control described in this article

*Leeds and Northrop.

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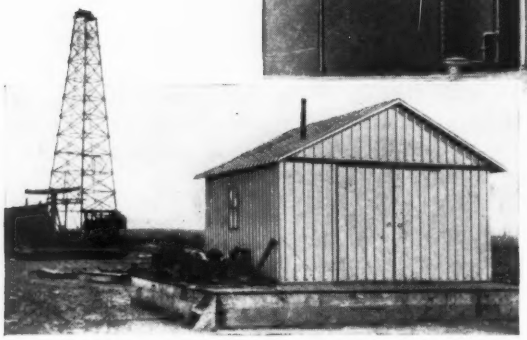

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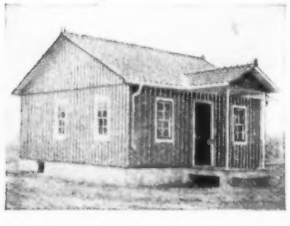

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Laboratory Aids in the Control of Fractionators

By W. W. Robinson, Jr.*

SINCE the formal recognition by the petroleum industry that natural gasoline is of great value, the fractionator has become a prime factor in equalizing quality of product. While it is possible to control the quality of "casinghead," this product varies widely with different plants; the fractionator has facilitated the production of more uniform products with controlled properties.

The adoption of the fractionator in the natural gasoline industry has naturally reacted on the chemist, and has demanded of him a technology applicable to its adequate control and operation.

The present time finds many different types of fractionators available to the manufacturer, the operation and control of which are subject to as many different methods and tests. Keeping this in mind, and realizing the practicability of analytic control methods not mentioned, the following may prove useful:

Fractionator operation has been subjected to a severe analysis inevitably resulting in changes in feed introduction, reflux control, preheating, etc. Figure 1 illustrates a type where the vapors created by the distillation are condensed and refluxed by a water-cooled condenser located directly on the top of the column. To the left will be noted a weir through which the reflux is returned. By observing sharply, a metal scale will be noted. This scale reads in gallons per hour, of reflux, and is useful in control.

On the ground will be noted an instrument board with temperature controllers for reflux and re-boiler, and recorder for pressure. The re-boiler is adjacent to the instrument board, at the right.

This method of operation has not been entirely satisfactory in that the proper degree of reflux control is not readily attainable. Some engineers are of the opinion that, if it were possible to obtain a high enough degree of cooling, the amount of reflux generated would still be uncontrollable. Scale deposits in the water tubes are a prolific source of trouble, and cause a reduction in cooling efficiency.

Figure 2 gives an imperfect view of a fractionator without a water reflux condenser. With this arrangement, the vapors pass overhead through the line shown, and are condensed and stored in an accumulator. The condensed vapor or reflux, is picked up from the accumulator and returned to the fractionator.

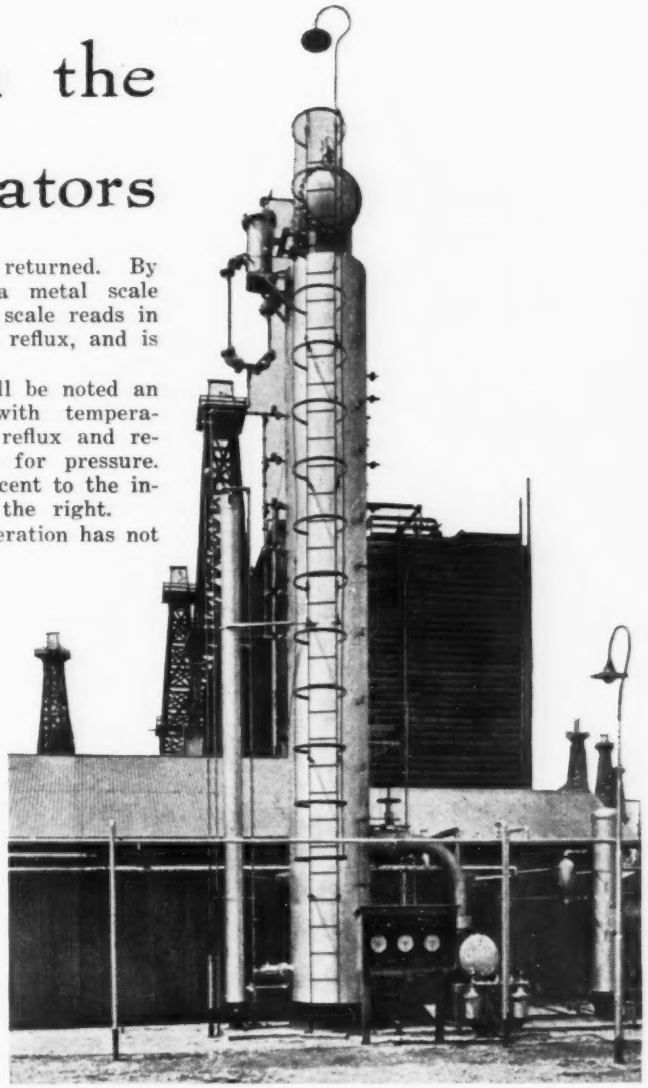


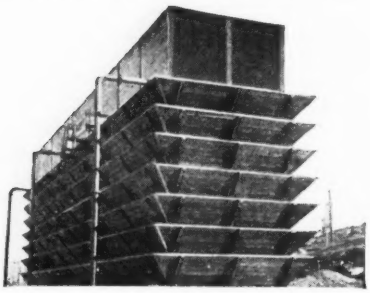
Fig. 1—Rectifying column equipped with water cooled condenser on top and device for measuring reflux in gallons per hour

*Chief Chemist, Producing Dept.—Gasoline Division, The Texas Company (California).

Table No. 1

Composition and Characteristics of Natural Gasoline with 90% Engler Recovery

Sample	1	2	3	4	5	6	7	8	9
Fractionator Press (# Gauge)	23.0	190.0	170.0	.....	175.0	145.0	200.0	210.0	150.0
Top Temp. °F	30.0	100.0	100.0	.....	100.0	.....	.....	90.0	138.0
Top Temp. at 1 Atm.	-12.0	-50.0	-42.0	.....	-45.0	.....	.....	-62.0	-7.0
Still Temp. °F	120.0	265.0	272.0	.....	265.0	225.0	289.0	274.0	255.0
Gr. °HPI 60°	85.2	86.4	85.4	82.1	84.9	83.0	86.1	79.4	78.3
IBP	63	70	65	69	71	66	66	70	65
5%	69	75	71	....	74	70	71	....	72
10%	73	78	73	82	78	78	74	86	83
20%	82	86	82	94	88	90	81	101	95
50%	124	107	124	136	127	133	117	147	154
70%	186	144	187	178	170	177	166	189	205
80%	217	202	194	209	198	198	204	212	233
REC %	89.5	90.0	90.0	90.0	90.0	90.5	90.0	90.0	90.0
ICC—Vap. Press. at 100°F (# Abs.)	29.0	26.7	29.0	26.5	28.0	28.5	27.5	28.0	26.5
Reid Vap. Press. at 100°F (# Abs.)	25.5	23.0	25.0	25.0	26.5	24.0	23.0	25.0	21.5
Propane %	0.2	1.6	0.7	2.6	2.4	2.6	.....	2.8	1.4
Iso-Butane %	2.5	9.0	9.1	3.4	6 9	6.5	6.5	4 8	2.7
Butane %	32.0	21.3	24.7	17.8	15.5	20.2	26.0	12.0	19.1
Pentanes, plus %	65.3	68.1	65.5	76.2	75.2	70.7	67.5	80.4	76.8



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This system is advantageous in that it permits flexibility in establishing different reflux ratios, whereas, the arrangement shown in Figure 1 is restricted.

In general control work, an interesting and very useful tool is a comprehensive vapor pressure chart. Figure 3 illustrates one developed by E. R. Cox of The Texas Company. Suppose a fractionator is operating at 185.0 pounds gauge pressure and 150.0 F. top temperature by referring to the chart it will be noted that this coordinate lies between the vapor pressure curves of propane and isobutane. Now, if it were desired to alter the top temperature, the resulting pressures could also be predicted by assuming that the vapor pressure characteristics of the reflux resemble a pure compound. Hence, if the temperature were changed to 175.0 degrees F., it could reasonably be expected that the pressure would change from 185.0 pounds gauge to 255.0 pounds gauge.

First, plot the temperature and pressure for existing conditions, and then extrapolate in the direction desired, giving the line a slope equivalent to the general slope of the pure substances. The dotted line in Figure 3 indicates this. From this it is evident that a change in pressure may be plotted, and the corresponding temperature obtained, or conversely.

Another interesting use of the vapor pressure chart is that of determining the equivalent atmospheric boiling point of the vapor leaving the fractionator. This procedure has its advantages in that it reduces varying temperatures and pressures to a common basis. For instance, the boiling points, at one atmosphere (14.75 pounds per square inch) of the lighter hydrocarbons are as follows:

Ethane	—88.3°C	—127.0°F
Propane	—42.2°C	— 44.0°F
Iso-Butane	—12.2°C	+ 10.0°F
Butane	— 0.6°C	+ 30.9°F

If fractionator conditions indicated a pressure of 170.0 pounds gauge and a temperature of 100.0 F. there is no "earmark" whereby one might mentally associate these values. However, if they were extrapolated to atmospheric pressure, a temperature would be obtained which could be classified among those for the fractions listed above. In this case, the resulting temperature would be —45.0 F. which lies close to the boiling point of propane.

Under normal operating conditions, it is reasonable to expect that the composition of the overhead vapors will be closely associated with the composition of the reflux. Hence the analysis of reflux is an important matter.

With the introduction of fundamental analysis, the possibility of knowing reflux composition was realized, but, even with this, the important time factor was not overcome. A sample submitted for analysis at one time would not necessarily, and in all probability, not represent reflux composition an hour later. For exact purposes of evaluation, fundamental analysis is indispensable, as will be shown later, but a more rapid test which may be conducted away from the laboratory is necessary. The "weathering test" fulfills this requirement in a most practical manner.

Figure 4 illustrates the laboratory equipment for conducting weathering tests. This particular arrangement, however, being on a much more elaborate scale than would be required at a plant. Following the details of the picture from left to right, a chainomatic specific gravity balance will be noted, behind which is a pressure vessel for creating hydrostatic pressure up to 125 pounds per square inch by means of water and compressed air. Next will be noted a 100 cubic centimeter Pyrex ignition tube attached to a ring stand and suspended over a Dewar flask.

The sample bomb will be seen in position on a metal rack, at the edge of the table. To one end of the bomb is attached flexible copper tubing which has been wound around the bottom of the ignition tube for condensing the reflux at atmospheric pressure, and then adjusted so as to discharge the condensed liquid into the tube.

The five test tubes mounted in position are arranged for a weathering test of five samples simultaneously. Referring back to the ignition tube over the Dewar flask, it will be noted that the flow of liquid through the condensing coil is controlled by a one-quarter inch brass angle valve.

The cooling bath consists of a 600 cubic centimeter silvered type Dewar flask properly mounted. The cooling medium is a mixture of carbon dioxide snow and acetone; the solid carbon dioxide being obtained by expanding gas from a cylinder of it, shown at the right, into a canvas, or, preferably, a chamois bag.

In making the tests, one end of the sample bomb is connected to the pressure vessel and the other to the copper tubing. The ignition tube is placed in position and the cold bath raised to immerse both coil and tube. The temperature is usually sufficiently low to hold the sample as a liquid until the tube has been filled somewhat above the 100 cubic centimeter mark. The cold bath is then removed, and thermometer placed in it for precooling.

The ignition tube is quickly emptied to the 100 cubic centimeter mark and the precooled thermometer immersed.

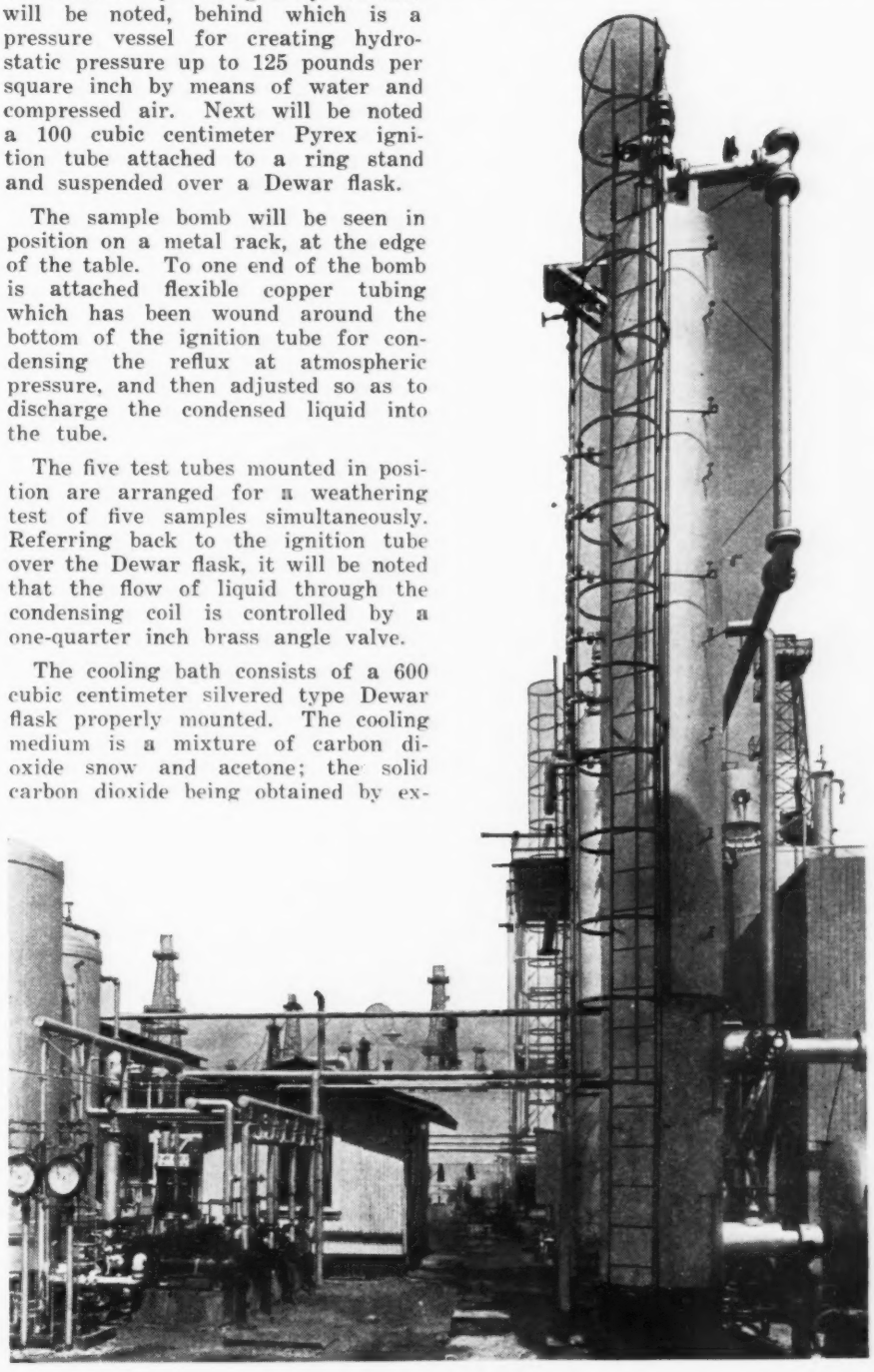


Fig. 2—Rectifying column without overhead condenser

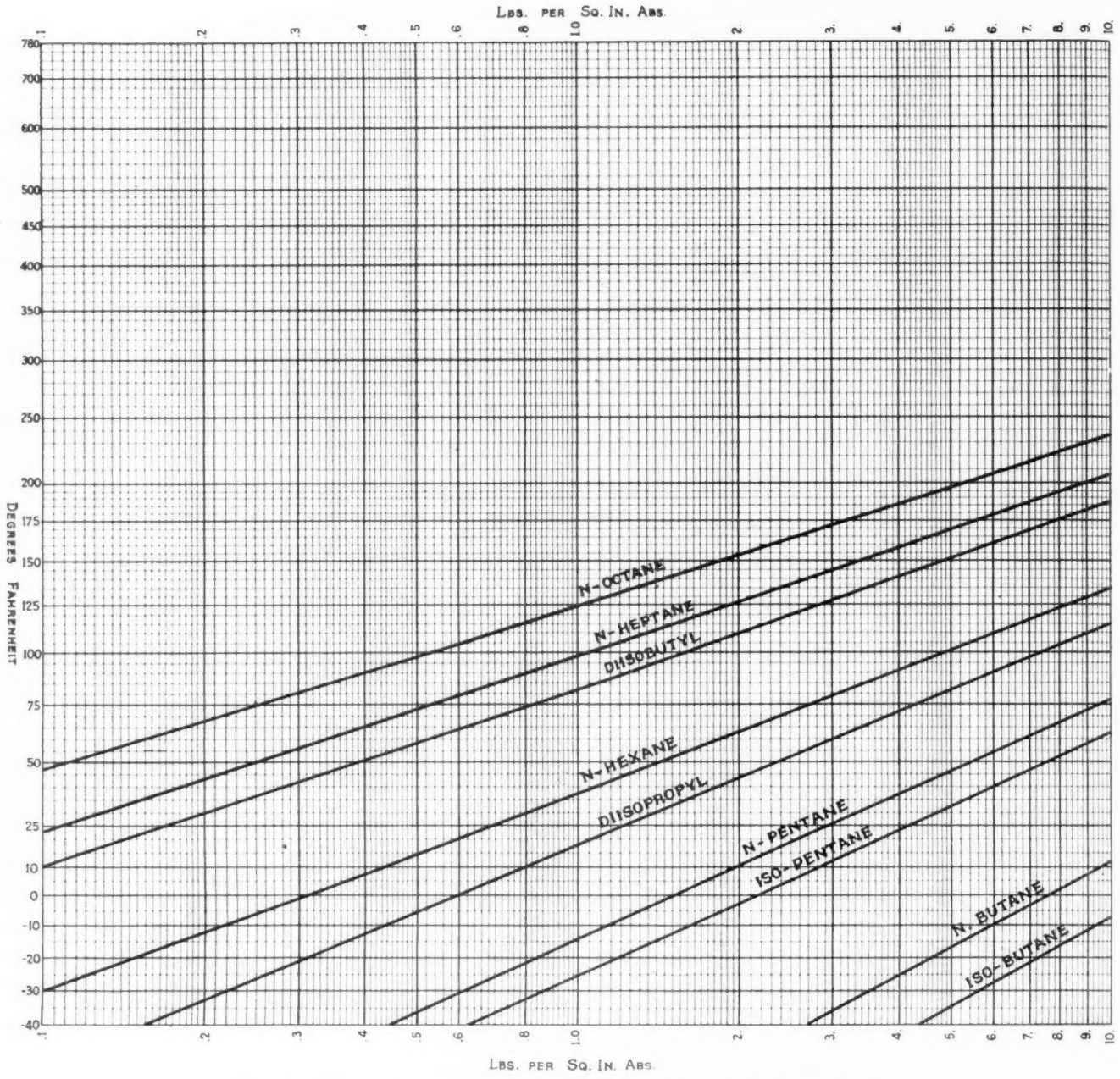


Fig. 3—Vapor pressure chart designed to aid in fractionator control

At the start, atmospheric temperature is sufficient to boil about 80 per cent off, beyond which volume a beaker of warm water, such as shown under the five assembled test tubes, will satisfactorily carry the distillation to dryness. A good quality of toluol thermometer is satisfactory.

When using a thermometer, an accurate end point is not readily obtainable due to the length of the liquid reservoir which necessitates an estimation as to the final boiling point of the last 4 per cent. However, a properly constructed thermocouple, in conjunction with a millivoltmeter would obviate this.

The test requires between 20 and 45 minutes to complete, and is remarkably free from the phenomena of "bouncing" or "puking" due to the layer of ice which is formed on the outside of the tube. The ice layer acting as a lower intermediate temperature.

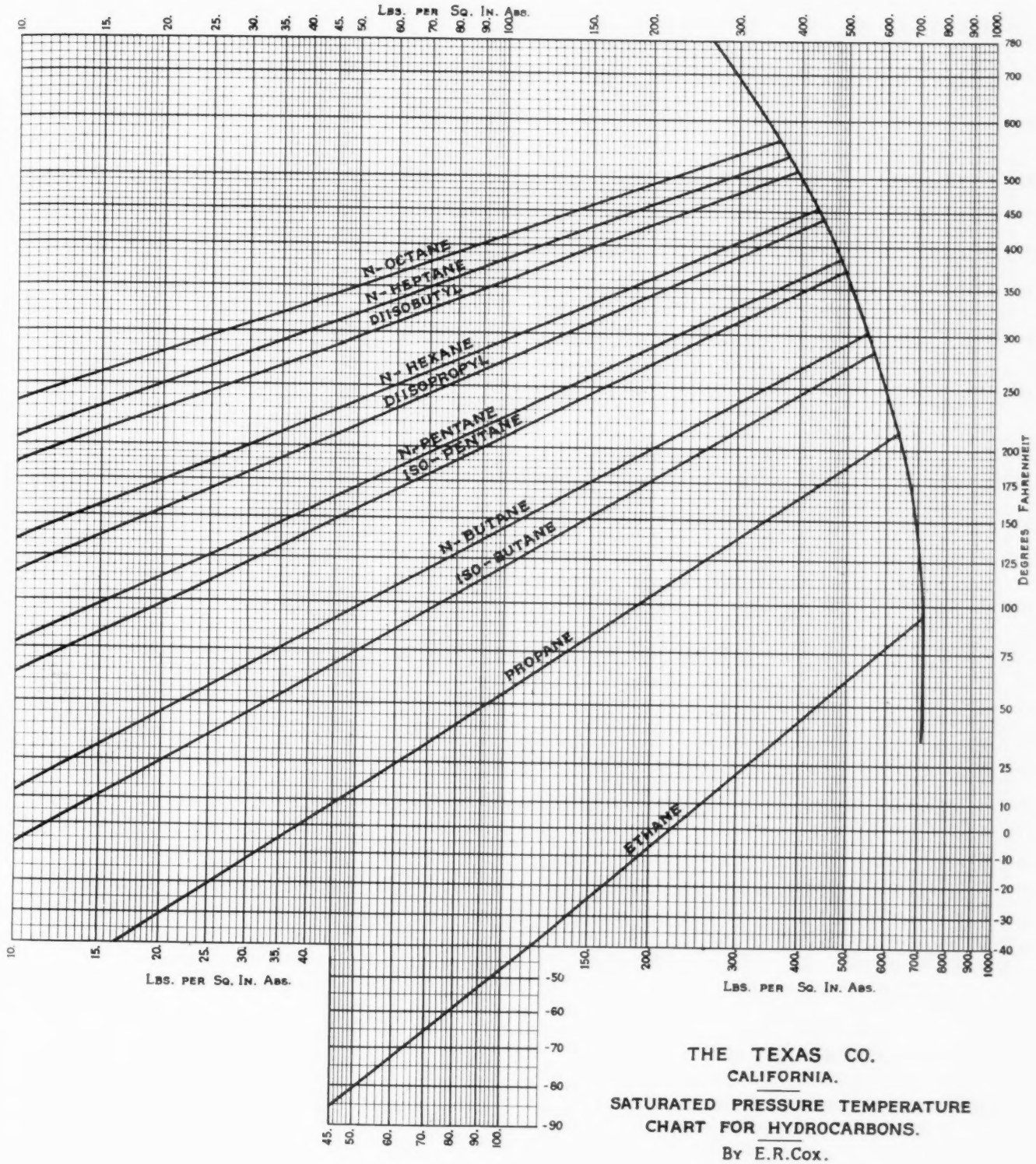
The function of the pressure vessel is to displace completely, with water, the volume of any sample withdrawn. This is accomplished by upward displacement under about 125 pounds. The illustrated vessel consists of a steel cylinder equipped with a compressed air inlet and outlet, gauge glass, and water inlet and outlet; the action being self-explanatory.

In control work right at the fractionator, a 100 cubic centimeter test tube and toluol thermometer are all that are necessary. By spraying the outside of the test tube with expanded reflux, it may be pre-cooled sufficiently to allow complete filling without boiling. After this has been accomplished, the procedure described may be applied.

A rough correction for thermometer immersion may be made by placing a scratch on the test tube above the 100 cubic centimeter mark when the tube contains its full volume of liquid, plus the immersed thermometer. This small correction may be carried through the entire distillation without trouble. The following table presents three weathering tests made on reflux with initial boiling points ranging from —51 F. to —13 F.

WEATHERING TESTS

Samples Per cent	No. 1	No. 2	No. 3
100	—51°F	—20°F	—13.0°F
95	—45	—18	+ 5.0
90	—44	—17	8.6



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By E.R.Cox.

80	—44	—11	14.0
70	—42	— 9	15.8
60	—40	— 6	19.4
50	—40	0	23.0
40	—38	+ 7	24.8
30	—36	+16	27.5
20	—33	+27	30.2
10	—26	+30	32.0
5	—20	+36	32.0

Fundamental analysis has received wide attention in the trade literature, and justly so. The appended bibliography will serve as a guide for those who wish to become acquainted with the opinions of various writers, and interesting discussion of the practical application of this method.

Any type of analysis, whether for fractionator control or not, must be assured primarily with proper samples. At the present time, the question of sampling is receiving serious attention by a committee of the California Natural Gasoline Association. In addition, this committee is also endeavoring to standardize the procedure of fundamental analysis.

A safe rule to follow for the sampling of overhead vapors from a fractionator, is to obtain a sample of at least 20,000 cubic centimeters. For sampling of this type, the bomb in Figure 5 serves very well, and is constructed cheaply. Two samples should always be taken, and the valve packings checked and the outlets plugged with ¼-inch plugs. Needle valves are satisfactory. The bomb should always be steamed thoroughly, in a vertical position, before filling.

An important point to remember when sampling rectifier overhead is

that the temperature of it is usually considerably above atmospheric temperature. From this it is logical to suspect that a certain amount of condensation will occur within the bomb after cooling has taken place. To obviate this difficulty when introducing the gas into the analysis apparatus, it is advisable to attach a pressure gauge to the bomb, and immerse it in a bath of either water or light oil, and heat the contents until the indicated pressure exceeds slightly that of the fractionator at the time the sample was taken. This should preclude the possibility of any condensed liquid remaining within.

Fractionator feed, product, and reflux should be sampled in the liquid phase. Figure 6 illustrates a bomb identical in construction to that shown in Figure 5, but of smaller capacity.

There are two classes of liquid samples: those taken under source pressure in sealed bombs; and those taken at atmospheric pressure in bombs, cans, or bottles. Needless to state, pressure samples yield far more reliable analytical results. All bombs for liquid samples should be purged with saturated steam, after which the valve packings should be tightened. Those for pressure samples should not be filled with water previous to sampling, except where the downward displacement method is used.

Hydrocar b o n mixtures which incompletely fill a tank, and are covered by a saturated vapor, are sampled satisfactorily by connecting the lower end of the sample bomb to a gauge glass, or some other connection below the liquid level, and the upper connection to the vapor space. In actual procedure, the connection to the vapor space is allowed to purge, and is attached to the bomb. The vapors are allowed to blow through prior to the lower end being connected to the liquid source. The incoming liquid meets its own saturated vapor and should represent a good sample.

The downward displacement method is applied by allowing the bomb to hang in a vertical position in such a manner that the incoming sample will be at the top. The top valve is opened wide and the displacement of water controlled solely by the lower one.

No method is presented here for sampling with open containers as it represents a technique which should be completely discouraged.

Figure 7 shows a view of the type of apparatus employed for making fundamental analysis. The column to the left being a liquid column and

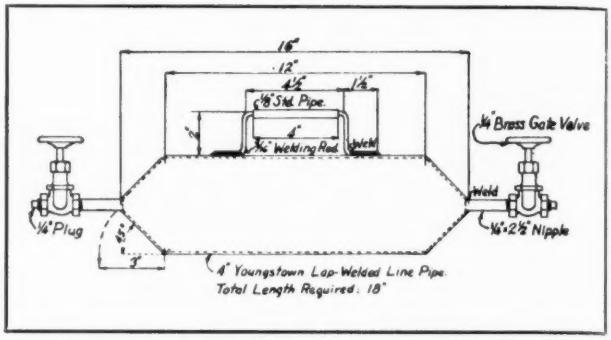

Fig. 5—20,000 cubic centimeter sampling bomb for use in fractionator control work

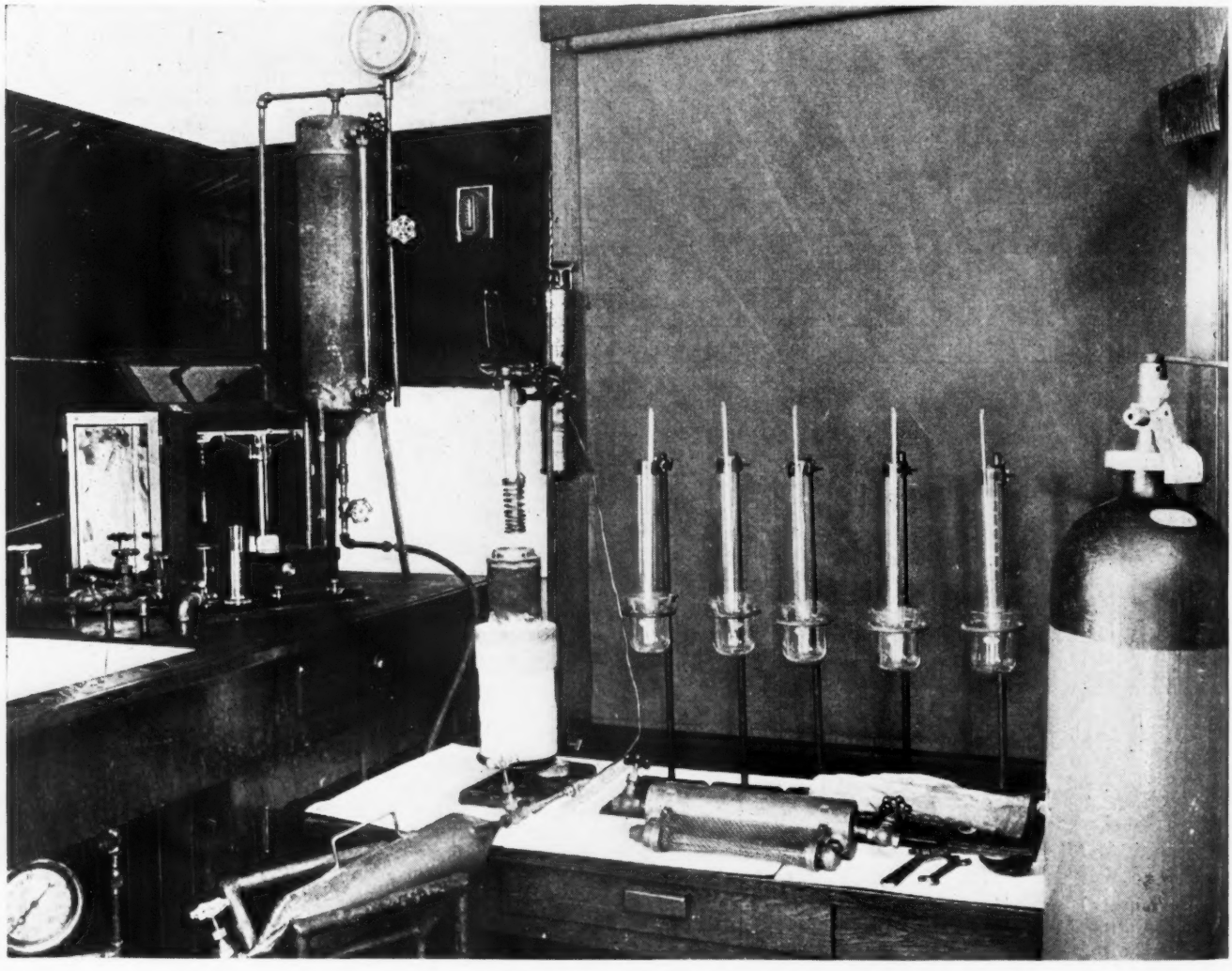

Fig. 4—Laboratory equipment used in conducting weathering tests

that to the right for gas. The view presented is not up-to-date; present equipment being much more refined and improved. However, the general description is the same.

The apparatus, speaking with reference to both gas and liquid columns, consists of distilling bulbs connected to a reflux condenser located at the top. Bulb and condenser being connected by a slender glass column packed with a Monel metal spiral. The reflux condenser is surrounded by a cooling bath. The cooling medium is a high gravity gasoline in which is immersed a cooling finger connected to a bottle of liquid air. This arrangement is shown on the column at the left. The internal system is inclosed in a highly evacuated glass jacket.

Distillation rate is controlled in such a manner as to allow vapors to escape into the large glass bulb shown in the center. The temperature of the vapors leaving the top is carefully measured and recorded. After the large glass bulb is filled, its contents are removed by evacuation and the cycle repeated. Reflux temperatures, receiver pressure, and receiver temperature are carefully recorded throughout the distillation either for gases or liquids.

From this it is evident that as the distillation progresses a curve may be plotted, on graph paper, of receiver pressure against reflux temperature. Such a curve shows the breaks between fractions, and gives the number of millimeters receiver pressure increase per fraction. For liquid samples, this millimeter increase in pressure may be converted, by factors, to equivalent liquid volumes, and subsequently used in calculating percentages.

When samples such as reflux, liquefied petroleum gases, etc., are analyzed, it is advisable not to displace them directly into the liquid column. They should be displaced from the sample bomb by water pressure, and allowed to flow through 10 or 15 feet of copper tubing immersed in boiling water or light oil, in order that the expansion from the sample bomb will not encourage condensation and alter their composition.

An interesting application of fundamental analysis was made in determining the characteristics of various fractionator products yielding 90 per cent Engler distillation recovery. Table No. 1 gives a resume of the data obtained. The table forcibly impresses one with the tremendous utility of knowing "how much of everything" of an ultimate nature there is in a product meeting certain specifications.

Material balances may be determined, and an accurate insight gained as to the extent of overhead losses. In short, this type of analysis has opened the way to more sound and efficient gasoline plant engineering.

A point which should not escape attention is that the present status of ultimate gas and gasoline analysis is by no means one of perfection. Standardization is needed, not only in analytical technique, but in sampling as well. However, its introduction is a broad step in the right direction, and all concerned feel that the ultimate outcome will be of inestimable profit to refiner, manufacturer, and engineer.

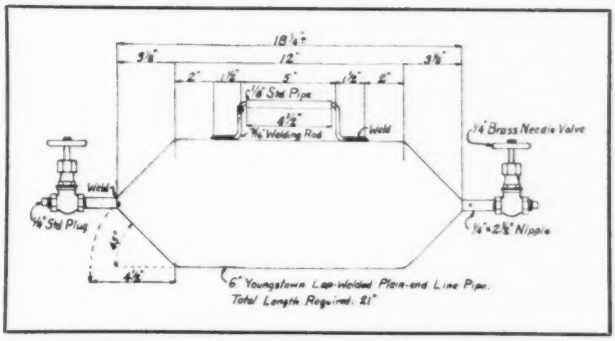

Fig. 6—Details of small sampling bomb built on same principles as that shown in Fig. 5

The past two years have brought many laboratory aids to the natural gasoline industry. Fractionator control has been reduced to an exact science in that the manufacturer must meet rigid specifications. The ever-opening market for liquefied petroleum gas will have an even more pronounced effect on future developments.

The chemist has contributed materially to the progress in fractionation of natural gasoline; consequently, any improvement or refinement of present technology or introduction of

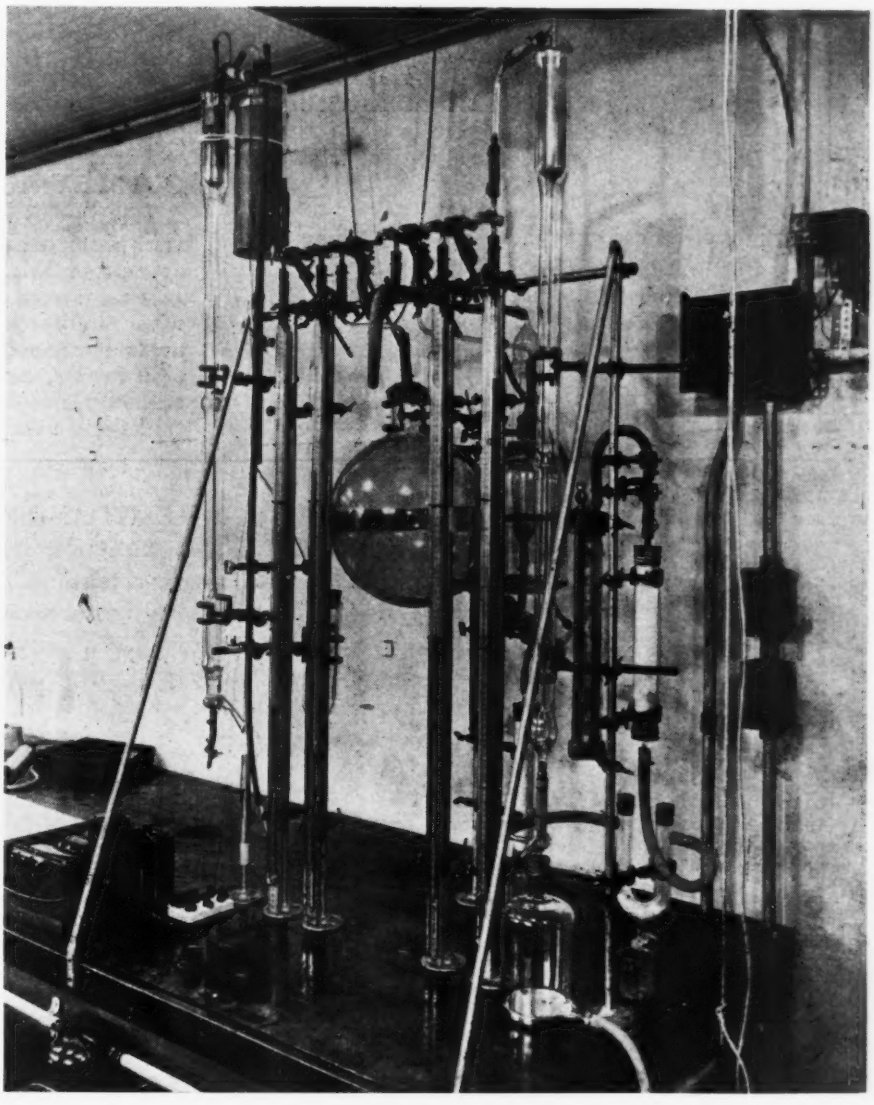

Fig. 7—Laboratory apparatus designed for fundamental analysis of natural gasoline fractions

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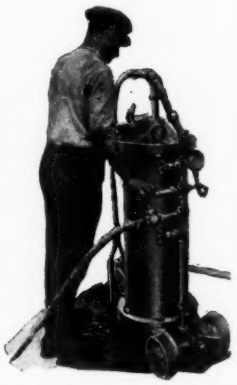

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Rectifier Control Requires Fixed Conditions at Two Points

By J. E. Kobernik*

THE natural gasoline manufacturer has been interested in conserving desirable constituents that have been extracted from natural gas ever since the art has been practiced.

Rectification, if it can be called that, was originally accomplished by weathering. This, of course, resulted in excessive losses and the final product was not propane free, neither could the quality of the product be controlled. Since necessity is the mother of invention, much time, talent and engineering has been concentrated upon obtaining the desired results, not only so that a finished product might be had to meet varying specifications, but to do it economically as well.

The success attending these efforts well merited the time and study spent and this article is confined to the explanation of how these results are obtained.

Nearly all gas treated for natural gasoline extraction contains methane, ethane, propane, iso-butane, normal butane, iso-pentane, normal pentanes and heavier, with air, CO_2 and H_2S present in varying quantities.

The butane and pentanes and heavier are the desirable constituents that can be used in liquefied form as natural gasoline. However, when extracting these constituents in varying quantities, there will be extracted some of the undesirable constituents such as methane, ethane and propane.

The amount of butane to be extracted in order to meet a certain grade of specification gasoline can be regulated by the amount of oil circulated through the absorbers, but the amount of light constituents extracted cannot be regulated in the sense that they cannot be completely eliminated in the absorption process. It, therefore, becomes necessary to resort to some other means of eliminating them in order to leave the finished product composed of such constituents as have been predetermined, and while eliminating these constituents, the main object is to retain all of the desirable constituents without losses.

While each individual problem is a specific one involving certain conditions, however, a well designed rectifying column can meet a number of conditions. In other words, it has the flexibility to take care of a minimum and maximum condition, and with proper methods of control should take care of either or intermediate conditions with an equal degree of efficiency.

The degree of separation, the operating pressure, the temperature in the bottom, the temperature at the top, the reflux ratio, and the plate efficiency will determine the number of plates to be used. When a separation between butane and propane is desired, the overhead from the column should not contain more than 2 per cent by volume of butane constituents, and the finished product should not contain any of the propane constituents. In other words, the overhead should not have more than 2 per cent of butane while the finished product should be absolutely propane free.

When desiring to separate between iso-butane and normal butane, the overhead should not contain more than 2 per cent of normal butane while the finished product should contain no iso-butane.

The pentanes-and-heavier have not been mentioned for the simple reason that the overhead should never contain any pentanes and the finished product should contain all the pentanes that were originally in the product in raw form.

A number of difficulties have been experienced in the operation of columns, where the temperature at the top, at the bottom, and the pressure on the column are fixed. The main trouble being that a surging effect begins to take place with an ultimate so-called puke. The reason for such a condition is that with the bottom temperature fixed, the pressure fixed and the top temperature fixed, any change in feed composition must of necessity result in an overloading of the column between the top and bottom plates, and when the overload becomes too great for the column capacity, a puke results.

It has been found advisable to limit only two points in a column. If the pressure and bottom temperature are fixed, we must leave the top flexible enough to take care of any fluctuating load that may be imposed upon the column, or if the temperature at the top and the pressure of the column are fixed, the bottom should be made flexible, or if the bottom temperature and top temperature are fixed, the pressure should be made flexible.

A rectifier, however, is operated for the purpose of getting some definite fixed product out of the bottom. It, therefore, becomes necessary to fix the bottom temperature at any definite pressure leaving the fluctuation to compensate for changing feed composition in the top of the column.

A desirable way of controlling a column is by introducing a fixed volume of reflux into the top. The amount to be introduced is predetermined by an analysis of the raw feed to be treated, and depends entirely upon what separation to make.

When controlling a column with a reflux volume ratio, it is possible to

J. E. Kobernik

*Vice President and manager, Engineering Research & Equipment Co.

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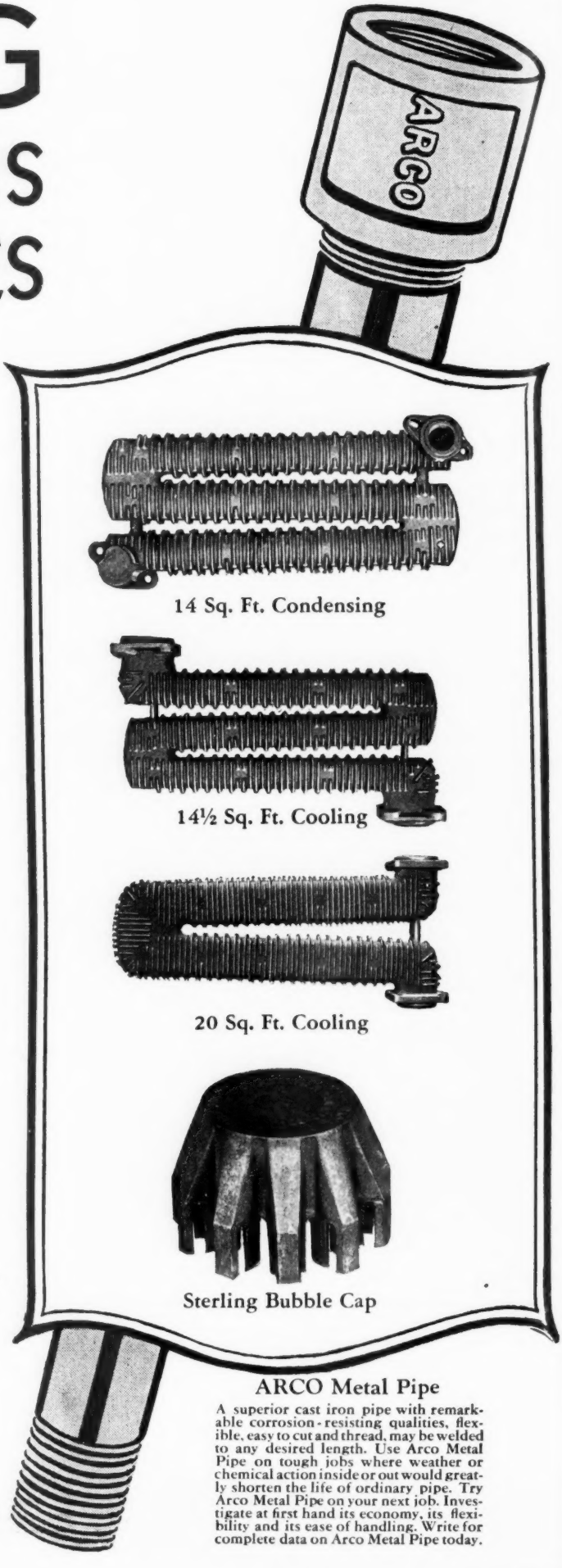

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permit a temperature fluctuation of quite a range without disrupting the operation of the column, while the feed composition varies over a considerable range. The temperature at the bottom and the pressure on the column are maintained at some constant point, thus assuring a uniform bottom product.

The control instruments such as kettle temperature controller, back pressure regulator and reflux control are the most important factors in controlling the operation of the rectifier. If either one of these instruments is more or less intermittent in its action there will be surging in the column with consequent loss in capacity and efficiency.

A properly designed rectifying unit with the proper control equipment will produce a finished product containing only a trace of the undesirable material in the finished product.

Factors to be Considered in Choosing Compressor Equipment Types

By E. W. Jordan*

WHAT type and size of compressors and equipment should I use?

The above question is a vital one to the man who has a quantity of gas to place on the market, or to produce gasoline, also the man who requires air under pressure for the transmission of energy to distant points.

The first step in the answer is to determine the amount of energy required at the point of application, whether for the purpose of transporting gas through pipe lines, extracting gasoline, or operating pneumatic appliances, placing pressure on producing sands, flowing oil wells, etc.

This step takes care of the horsepower required, or the horsepower rating of the prime mover.

The next step is to determine the type of unit that should be installed, the deciding factors for which should be cash available, local installation conditions, such as water, space, condition of soil, and accessibility.

This brings us to a discussion of the various types of compressors now in most general use. They can be divided into four classes:

Horizontal, belted, to be driven by any motive power.

Horizontal, direct connected, to any motive power.

Vertical, to be belt driven.

Vertical, to be direct connected.

Each class has its good and bad qualifications, and they will each and every one fill the bill in a general way; but no one of them will cover all conditions or requirements equally well.

The belted compressor was most extensively used for a great number of years and was a prime favorite until very large units were required, when direct connected units were resorted to.

The belted unit lends itself to the handling of small propositions better than the direct connected unit, up to units of 40 horsepower, or more. While there are direct connected units of less than 40 horsepower they are not in general use for continuous operation, under heavy loads.

On the other hand, the belted compressor is sometimes built in sizes of 150 horsepower to 200 horsepower for continuous and heavy work, and a few years ago they had quite a run with some of the larger gasoline companies. The belted compressor can be made just as sturdy, just as neat and just as volumetrically efficient as a direct connected compressor, but the belted unit never can be made as mechanically efficient as the direct connected machine, also they are more expensive to install, requiring increased amount of concrete for foundations and larger building according to the distance of belt wheel centers.

As to purchase price, a first-class belted compressor in combination with a gas engine of equal quality costs as much, if not more, than a direct connected gas engine driven compressor of equal capacity and quality. Primarily this is the reason that belted units are not used for large units in the same proportion as formerly, but they are still used in small units to as great an extent as ever. Also, a direct driven compressor compared with a belt driven unit of equal brake horsepower, if properly designed, should deliver about 10 per cent more gas under like conditions.

It is a notable fact that all, or nearly all, manufacturers who formerly built belted units are entering the direct connected field with high grade units, both two and four cycle engines. (Their comparative qualities may be discussed later.)

The above remarks apply to horizontal compressors and engines and are equally applicable to the vertical class, both belted and direct connected.

The vertical machine has some advantages over the horizontal type, also some disadvantages.

Some of the advantages are: There is less trouble with vibration of buildings and foundations where the footing is of poor quality; reciprocating parts can be made more accessible, especially the cylinder heads and pistons, but not so with the crankshaft.

*Cooper-Bessemer Corp.

On the other hand, the actuating mechanism is at a considerable height from the floor, and on account of having to use a flight of stairs to reach these parts they are not liable to receive as good attention as would a horizontal unit, eventually running into trouble and expensive repairs. The cylinders are in direct path of any heat generated in the lower part of the plant, interfering with heat transference by radiation from the cylinders.

The horizontal direct connected compressing units have all the virtues and few of the faults of the preceding classes. They are capable of high volumetric and mechanical efficiency. The available horsepower is applied direct to the operation to be performed; there is no belt or belt wheels to fan the air, and very little friction. The building to house them can be one-half the width and less height than would be used for belted units; only one foundation instead of two. Being low down they would receive better attention from the operatives, consequently less trouble and less expense for repairs and stoppage of production. The horizontal unit will give more vibration on a poor footing than the vertical one will, but the accessibility of parts will average higher than most any other type of unit.

As stated before, any of the types of compressors can be operated by any prime mover available, but where formerly the steam engine was the favorite drive, at the present time it is very little in use for this purpose, its place has been usurped by the gas and oil engines, and quite frequently electric motors.

The advantages and disadvantages of the various prime movers can well be touched on at this point and discussed as to their suitability for specific conditions, for in speaking of a compressing unit as a whole, the motor is a very important part of it and should be considered integrally with it.

First, let us consider the electric motor. This motor can be either

Sheppard plant of the Skelly Oil Co., Earlsboro, Oklahoma

belted or direct connected to a compressor through its crankshaft, its advisability depends on the location at which it is to be operated.

If the location is such a place that noise and vibration is objectionable, and electric current is available, use an electric motor by all means. If the power house of a large manufacturing concern is some distance from center of operations, where a large amount of air is being used, a suitable compressor could be placed centrally, to save pressure, volume, and piping expenses, then use an electric motor.

Electric motors have been used as a power unit for driving compressors in gas fields, but it seems with indifferent success, as they do not seem to be displacing gas and oil engines to any great extent.

Oil engines have been used extensively as a motive power for operating compressors, both belted and direct connected, in localities where gas is scarce and consequently expensive, using air for repressuring the producing sand, and commercial air service, they are very satisfactory for those conditions.

The real power for compressor driving is the gas engine, both in the two and the four cycle types. They are economical in fuel, practical, give long, continuous service, operating for months and months without stopping, running 24 hours a day, equaling the steam engine in reliability and flexibility.

At the present time they are so improved and perfected that they are masterpieces of mechanical genius, and they are manufactured in capacities in the direct connected units from 40 horsepower to 1500 horsepower and in the belted units from 5 horsepower to 200 horsepower.

The four cycle gas engine in the past has been considered the logical unit where there was a scarcity of gas, or where a good price could be secured by placing the gas on the market, and they can be secured in larger units than the two cycle engine, the only drawback being that they are somewhat more complicated and really required a higher grade operator to secure the best results.

On the other hand, the two cycle gas engine was very simple and required very little attention, aside from seeing that it received proper lubrication and cooling. But in recent years the two cycle engine has been so improved and perfected that it takes its place along side of the four cycle engine for economy without the complications inherent to that class. But it is limited to a power cylinder 16 inches in diameter by 20-inch stroke, as being the most practical size, this originally confined the two cycle engine to a maximum rating of 80 brake horsepower per power cylinder at 180 revolutions per minute and a mean effective pressure of 56 pounds. Now that the gas injector has been applied to the two cycle engine the mean effective pressure has been raised to about 80 pounds. This possible increase in mean effective pressure allows a safe brake horsepower rating up to 100 for each 16-inch x 20-inch power cylinder, and the gas consumption is practically the same as the high grade four cycle unit.

The foregoing discussion shows that all types of compressors have their uses, and that every condition has a type of unit to take care of it, but great care should be taken not to get the wrong combination.

For instance: If you already have a power plant in operation, with some surplus power, and the installation of a compressor were advisable, said compressor needed only during the operation of the plant, I would not consider it good practice, or economy, to install a direct connected unit. There are many variations of this condition.

If you have an idle power unit lying around it would not be advisable to purchase a direct connected unit for temporary work. Get a belted compressor for the idle power unit.

If space is scarce and valuable, don't buy a belted unit.

If you contemplate installing a gas compressing plant in the field for the purpose of repressuring producing sand, or extracting gasoline, or as a gathering or boosting station, use the direct connected two cycle units with latest improvements, using single units or a multiplicity of units up to 200 horsepower each to fit your conditions.

If you have in mind the transportation of large quantities of gas long distances through pipe lines and continuous operation is imperative, install several large four cycle units of proper capacity to handle the maximum load, and two additional units, each one-half the capacity of the main machines, these for emergency purposes and to maintain the most economical plant operation.

You will be surprised at how flexible those two half size units will make the plant.

I realize that a short article like this with the above title cannot contain very much useful information as compared to the amount which this subject requires.

Precautions Necessary to Obtain High Distillation Efficiency

By F. L. Kallam, M.E.*

DURING the past few years the determined effort of the entire natural gasoline industry to reduce the gasoline content of the processed gas has led to the general acceptance of the bubble-type absorber as a means toward this end. Further economies have been effected by refractionating the product itself, thereby eliminating the loss of desirable gasoline constituents along with the undesirable fractions as occurred under the older regime of natural weathering.

Such fractionation also offered means of segregating the undesirables into their component parts, and as a result, the past two years have seen the birth and thriving growth of the Industry's first commercial by-product —liquefied gases. It is of small wonder that the Industry at large, in sponsoring such an extensive campaign of progress and new development, has given comparatively little thought to the development of the plant distillation unit itself, and consequently, the technique of this phase of the problem has virtually marked time.

The Distillation Unit

Generally we think of the distillation unit as that portion of the plant equipment whose function it is to remove and recover the gasoline from the enriched absorber oil, thereby fitting the oil for reuse as an absorbent. Such a unit necessarily consists of a still, fractionating column, oil to oil exchangers, oil preheater, oil cooler, partial vapor condenser or its equivalent, and the final vapor condenser and cooler.

The efficiency and proper functioning of this type of unit does not therefore depend upon the efficiency or excellence of one piece of equipment, but upon the combined efficiency of a group of inter-connected apparatus. The overall group efficiency is indicative of the thought and care given the original design, and may be best gauged by means of the heat-balance for any one degree of fractionation under consideration.

In the early days of the industry the stills in which the gasoline vapors were driven from the enriched oil were originally of the horizontal shell-type where the oil was heated by means of closed steam coils, with sufficient live steam introduced into the body of the oil itself to properly reduce the effective pressure on the evaporating gasoline.

Due chiefly to the large dimensions of these stills it was necessary to operate them at very low pressures, such as two to four pounds. Subsequently horizontal shell-type, receiving heat from direct-fire, were extensively used, showing that the early pioneers had the first prerequisites for maximum still steam economy; namely, minimum total still pressure, and maximum still temperature.

These very desirable low still pressures were later abandoned, however, because of the difficulty in pumping the hot stripped oil from the stills. As a remedy for this condition, the oil was gravitated through a heat-interchanger in order to reduce the pumping temperature, which resulted

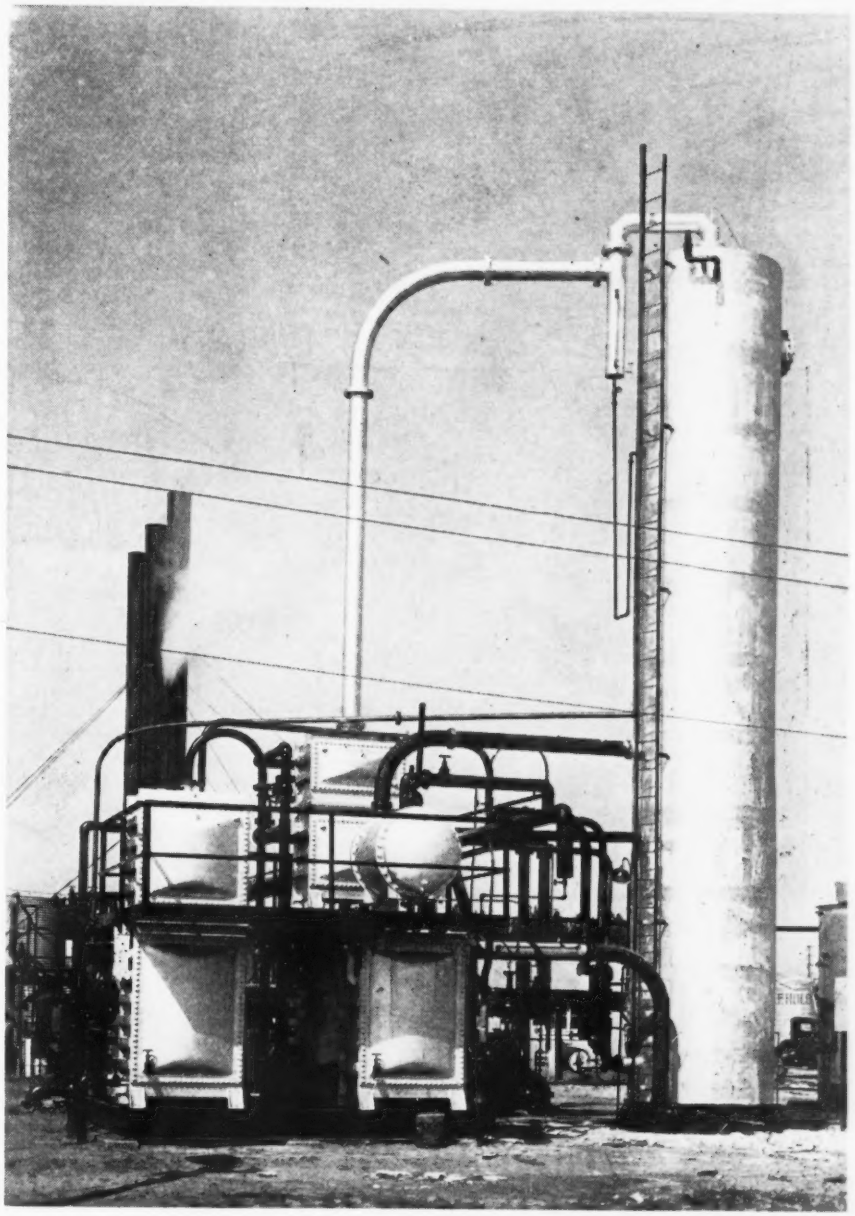

Fig. 1. A modern distillation unit

*Engineer in charge of petroleum research and development, Southwestern Engineering Corp., Los Angeles.

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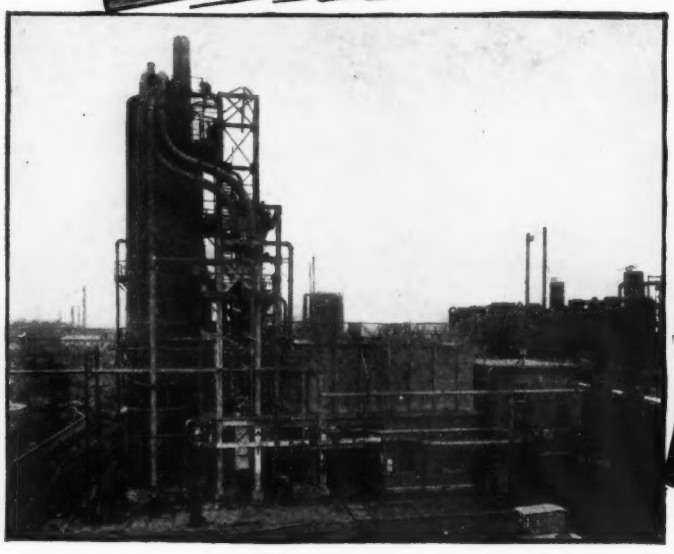

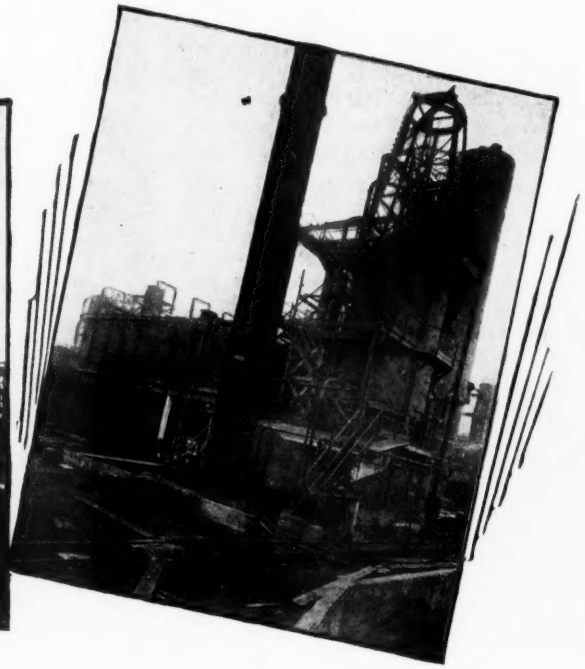

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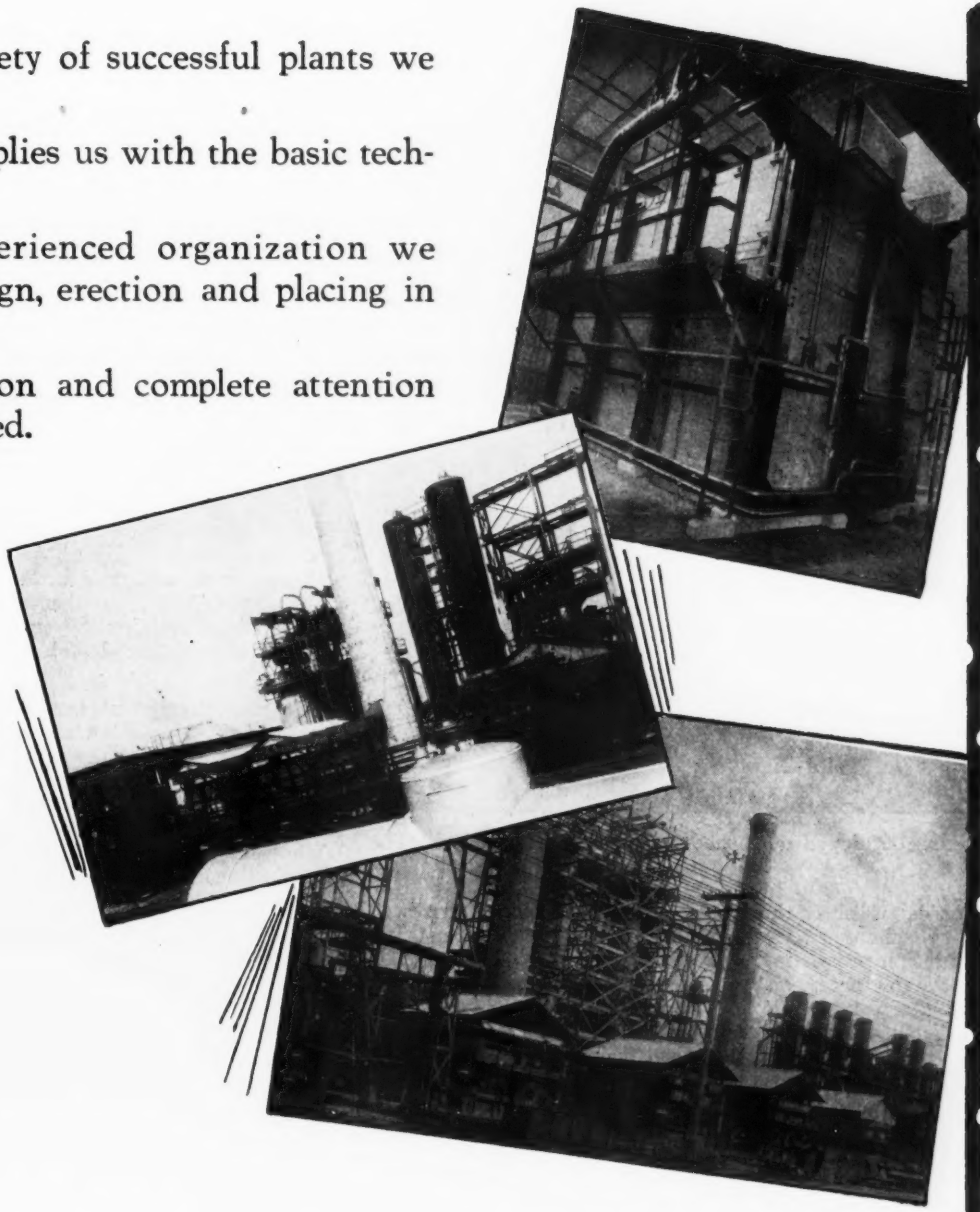

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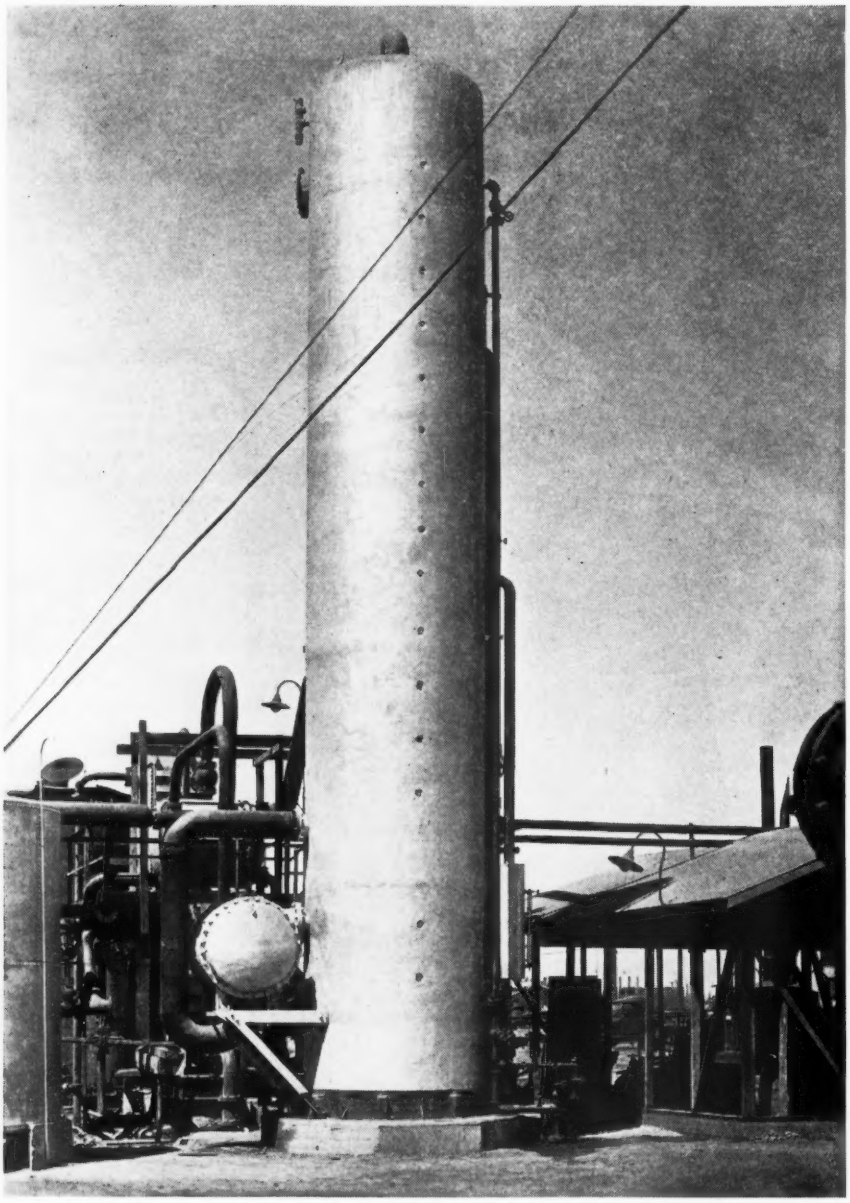


Fig. 2. Fractionator column equipped with modern external type of reboiler

in the quite common practice of elevating the stills above the exchanger equipment. Later the distillation pressures were raised in order to force the stripped-oil through the exchangers and into the lean oil tank from which the pump took suction.

In raising the distillation pressure the condensing pressure was likewise raised, which naturally increased the condenser efficiency and resulted in a higher gravity product as well as a larger plant yield. From this time on all new installations were designed for distillation pressures of from 20 to 35 pounds, thus giving preference to the condensing phase of the problem.

The original shell-stills were equipped with no form of fractionating column so that the amount of rectification obtained was negligible and of no moment. For the purpose of controlling the final boiling-point of the product so called "dephlegmators" were used, and these were nothing more or less than conventional primary condensers. Needless to say they did not make a sharp-cut between the absorption oil and gasoline fractions removed from the gas, the nature of the condensate being that of a usable motor fuel, which was used as such or returned to the enriched oil going to the still.

Some improvement over this method was finally made by the general adoption of a column placed over the still through which the vapors passed on the way to the dephlegmator. The oil to the still was generally fed into the middle of this column, while the condensate from the dephlegmator was returned into the still proper. The fillings for these columns varied considerably, crushed rock, however, being the favorite.

As time went on, many modifications of the above system were employed, the predominating one being a filled column separated from the still, where the temperature of the final vapor was controlled by the quantity of water sprayed into the apparatus. This cooling water was then separated from the condensed reflux, the latter being returned to the system through the rich oil while the water was recooled and used over again.

With the advent of better tower fillings, such as wood and metal grids, tiles, and the like, vertical stills were built in which steam for heating and agitation was used. Direct fire heating of the oil was done away with through the use of steam preheaters placed in the rich-oil circuit between the exchanger and the still.

The enriched oil was introduced into these columns somewhere near the top, while the evolved vapors were removed from the extreme top in all cases. These vapors then entered the lower part of a second column, called a "reflux tower," the bottom of which served as a dehydrator for condensed steam and reflux. Vapor temperature at the top was controlled by either a partial condenser or, as previously, by a direct waterwash.

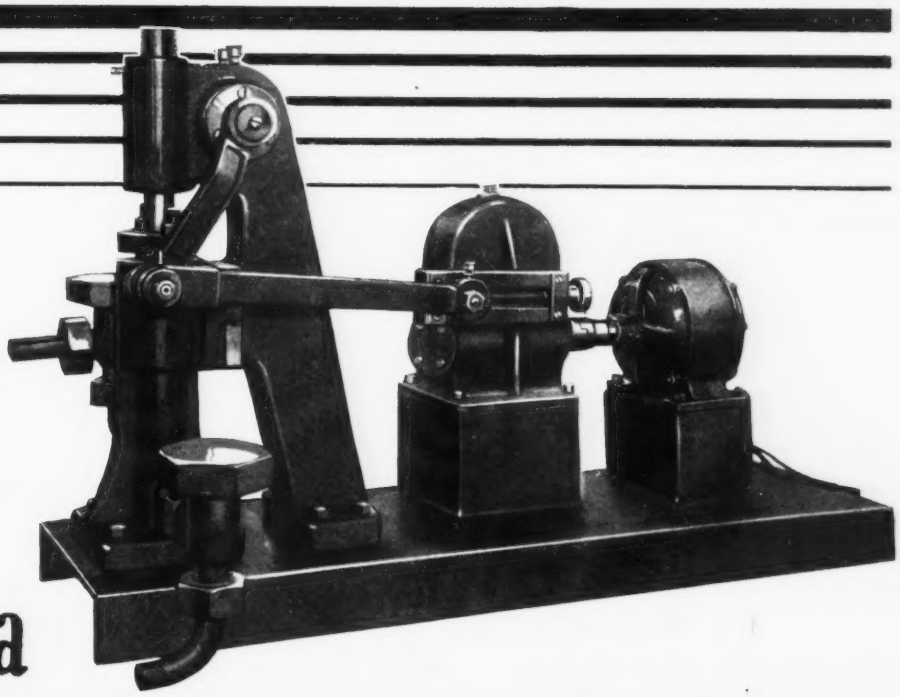
Modern Vertical Stills

Now, vertical stills, very similar in design to the bubble-type absorber, are in common use, and in these the still and reflux sections have been combined into a single-column. These columns are operated with great economy and with a simplification of the plant corresponding to that which ensues in the absorption system with the installation of the bubble-type absorber.

The most important contribution of this form of column is its greater efficiency in contracting the rising vapors with the downflowing reflux, and this feature has resulted in greater capacities per unit area of cross-section. With this combined still and fractionating column, the enriched oil, after subjection to steam heating in an insulated tubular preheater, is introduced into the middle of the column, the oil flowing downward through an upward flowing medium of steam and is removed in a stripped condition at the bottom. The vapors, composed of gasoline, oil, and steam, pass upward through the stilling-section into the fractionating portion of the column, where they are washed by the returning reflux.

This reflux may be formed from the vapors leaving the column in a number of different ways, such as condensation by passing through a tubular partial condenser or its equivalent, or by the introduction of a cooling medium into the top of the column itself, such as water, oil, or even the finished gasoline or some fraction of the final product.

In most instances, dehydrators are provided on the trays of the fractionating section so that the con-



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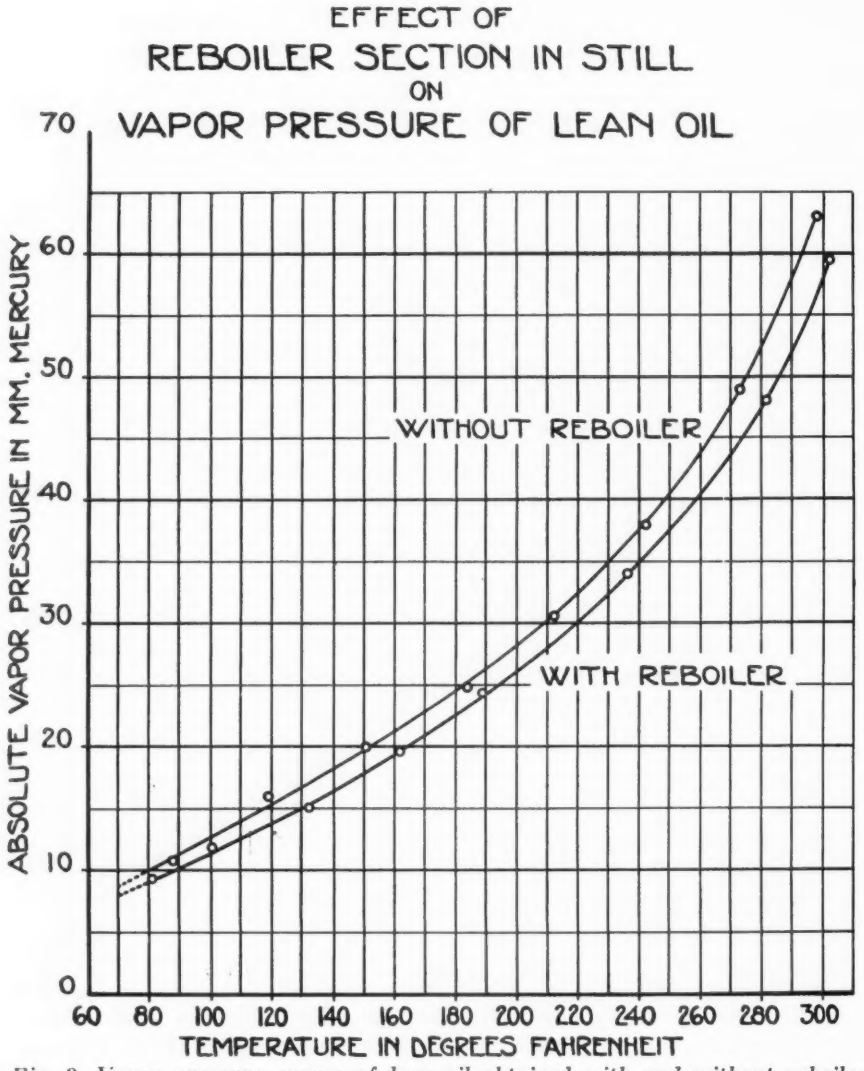

Fig. 3. Vapor pressure curves of lean oil obtained with and without reboiler in the still section

densed steam may be removed from the reflux, thus preventing the water from returning into the lower portion of the column.

It is evident that columns of today add nothing novel over that specified by Frasch in his patent granted in 1906, and the failure to apply these known correct principles in the past has cost the industry tremendous sums of money. As an example of this faulty practice, consider the case of the bubble-tray itself.

In a handbook of the industry published in 1922, there appears this statement in connection with stills, "The towers may be of the cap and bell washer type such as used in the alcohol and benzol distillation, but this is a refinement that is usually not warranted by the expense, the tower usually being filled with crushed hard limestone—." It was not until four years later that the bell-cap type of plate came into general use.

Again, as late as May, 1926, a manufacturer of plant equipment writes in connection with a reply to a criticism, "As a matter of fact, fractionation is not necessary in separating two media as widely separated naturally as are natural gasoline and the average absorbent oil." It is indeed fortunate for the industry today that all distillation units are not designed upon this basis.

Desirable Absorption Oil

The first requirement of an efficient gasoline plant is that the gasoline in the gas be removed and recovered in the oil. To efficiently accomplish this extraction the vapor pressure of the lean-oil entering the absorber must be low, so that the brunt of the problem after all really reverts back to the distillation unit. The still must therefore remove the dissolved gasoline from the enriched oil. At the same time, this removal must be accomplished without oil distilling-over along with the gasoline, and, as the best absorbents are necessarily oils of low-molecular weight, the need for a fractionator section is obvious.

Oils of this nature are those boiling in the neighborhood of 350 degrees F. with a final boiling point of about 450 degrees. As the average end-point of the gasoline in the gas is possibly 320 degrees F., it is apparent that fractionation and not a mist-extractor is required for an oil-free product.

In passing, it might be well to call attention to several other desirable features of the lighter-oils. In the first place, due to the low final-boiling-point of such oils, they have a higher resistance to emulsification; it having been definitely proven that the heavier fractions of an oil are more conducive to emulsion-forming than the lighter ones.

Secondly, the physical characteristics of the light-oils promote high heat-transfer rates far in excess of those obtainable with the conventional oils. Further, these characteristics result in the minimum power requirements for pumping the oil, which fact sums up a case highly in favor of the use of low-molecular weight absorbent oils.

Benefit of Low Pressure on Steam Rate

The knowledge is prevalent in the industry that the oil is more easily and economically stripped of its gasoline content at low-still pressures than at high-still pressures. Some interesting data is presented below which was taken in a plant where various distillation pressures were used, in each instance, sufficient steam being admitted to the still to give a constant vapor-pressure lean oil. In order to more clearly illustrate the results, the steam rate at the highest still pressure has been arbitrarily taken as 100 per cent.

With 25.0 pounds per sq. in. abs. still pressure, steam rate was 41.7% of that at 55 pounds.

With 37.5 pounds per sq. in. abs. still pressure, steam rate was 67.8% of that at 55 pounds.

With 46.0 pounds per sq. in. abs. still pressure, steam rate was 86.6% of that at 55 pounds.

With 55.0 pounds per sq. in. abs. still pressure, steam rate was 100.0% of that at 55 pounds.

The steam rate should show a reduction in direct proportion to the still pressure providing the still has been correctly designed.

Steam economy must be considered, and in fact, there never was a time in the history of the industry when steam was "cheap," even in cases where exhaust steam was used in the column. For every additional pound of steam required by the still there must be furnished additional condensing surface, which in turn must be supplemented with additional cooling-water and additional cooling-tower capacity.

Still size is also greatly affected by the volume of steam to be handled, so it is readily apparent that maximum steam economy in the still results in further economies throughout the entire plant in both first cost and operating expense.

The Reduction of the Still Pressure

Operation at low still pressures being quite desirable, it is reasonable to expect that stills of the future will be operated in this fashion. This possibly will be accomplished in several ways; the first and simplest being the reduction of the distillation pressure to a minimum for oil removed, and the handling of the resulting uncondensed vapors from the condenser by means of a compressor. In this age of rectification of the final product such a system will fit in nicely because the compressor may be operated at sufficiently high pressure to allow the gasoline condensed to flow directly from the accumulator to the rectifier.

The gasoline condensed in the usual manner, being very stable in this case, may be placed directly in the finished storage, or if it too needs rectification, it may be pumped into the high pressure accumulator in the conventional manner. Such a system affords low still pressure, high condenser pressure, and where the low pressure condensate is suitable to place directly in the final product a low rectification expense.

Again, the problem of operating the still at very low-pressures, such as atmospheric, and maintaining the present condensing pressures is being investigated. Two courses are available here, one in which a centrifugal compressor is used between the fractionating column and the condenser, and the second, the use of a thermocompressor in this same location but employing either steam or some other condensable fluid as an energizing medium.

The Effect of the Least Volatile Component Distilled Upon Steam Rate

Now a second factor which affects the steam economy of the still, in addition to the total pressure, is the heaviest component to be distilled from the oil. As the present analytical methods do not permit of the actual determination of these least volatile components, it will be necessary, for purposes of discussion, to assume this component.

For average plant conditions it is believed that decane is the heaviest component distilled. If steam be admitted to the still in sufficient quantity to volatilize this component, then all lighter fractions present will be likewise vaporized at no expense of additional steam. This is analogous to the oil-to-gas ratio in an absorber, where with a correct amount of oil to absorb one component, all components heavier than this will also be absorbed.

The steam rate to the still may thus be said to vary inversely as the vapor pressure, at the still temperature, of the heaviest component or least volatile fraction to be vaporized. From the discussion pertaining to the characteristics of the oils, it is evident that a considerable portion of such oils will be vaporized into the fractionating section, forming a heavy wash for the rising vapors, and it is in this way that the close fractionation is obtained between the oil and gasoline fractions.

Steam Rate Not Affected By Degree of Oil Saturation

A corollary to the fact that the quantity of lean oil required by an absorber for a given stripping of the gas is independent of the initial content of the rich gas, is that in the still, the steam required for a given temperature and pressure condition is independent of the gasoline saturation of the enriched oil.

The steam rate should therefore always be stated relative to the absorption oil rate and not the gallons of gasoline produced as is customary. Also, for a given steam rate, regardless of the saturation conditions, the lean oil will always be stripped to the same degree for any one condition of still temperature and pressure.

This is because at the top of the stilling section there is a relatively large quantity of gasoline in the oil which exerts a correspondingly high partial pressure. Likewise, although the steam is only partially saturated with gasoline at this point, it does carry a sufficiently large amount of gasoline vapor such that the corresponding partial pressure is relatively high.

It is possible under these conditions, however, for a definite proportion of the high vapor pressure liquid gasoline fractions to overcome the high partial pressure of the gasoline vapors, and evaporate out of the oil into the vapor stream. Now at the bottom of the still the gasoline fractions left in the oil are very small, and consequently they exert a very much lower partial pressure. Fortunately, the concentration of gasoline vapor in the steam at this point is also sufficiently low so that some of the liquid gasoline fractions can exert a sufficient pressure to evaporate into the vapor stream.

Necessity of Heating Oil Within the Still

Considering now the case where the still pressure and temperature are fixed, it is readily appreciated that less steam will be required to vaporize butane than hexane, in fact, these two steam rates will be to each other as the inverse ratio of their vapor pressures. The steam rate for hexane might be made less, and equal to that for butane, if the stilling temperature be raised to such a value that the vapor pressure for hexane equals that of butane. A high still temperature thus reduces the steam rate because the vapor pressure of the least volatile component to be removed from the oil is raised.

In the ordinary still, there is an appreciable drop in temperature between the oil inlet and the oil outlet, and it is at the oil outlet that the temperature should be highest if the maximum steam economy is to be obtained, other things being equal. The present temperature gradient is due to the oil giving up heat for vaporizing the gasoline, and this effect is greatest at the point of oil entry into the still or at the feed plate, where a considerable portion of the gasoline flashes because of contact with the steam laden vapors.

This drop in temperature of the oil in passing through the still varies with each installation, but in general is of the order of 20 degrees F., although in some instances it is often amplified by the heat given up in superheating the reduction steam. It is therefore advisable to supply the latent heat of vaporization to the oil within the still, and this can be done by the use of heaters on the vari-

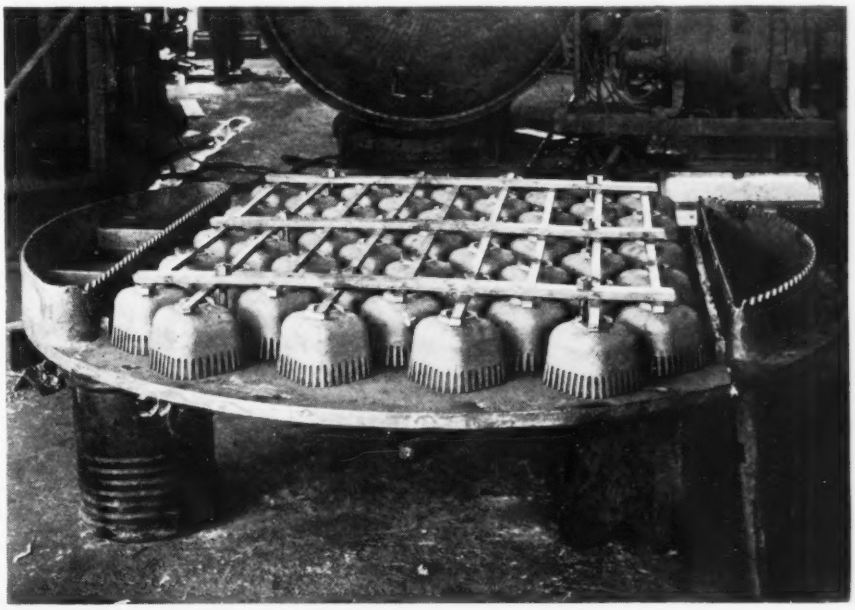

Fig. 4. Modern type of bubble tray

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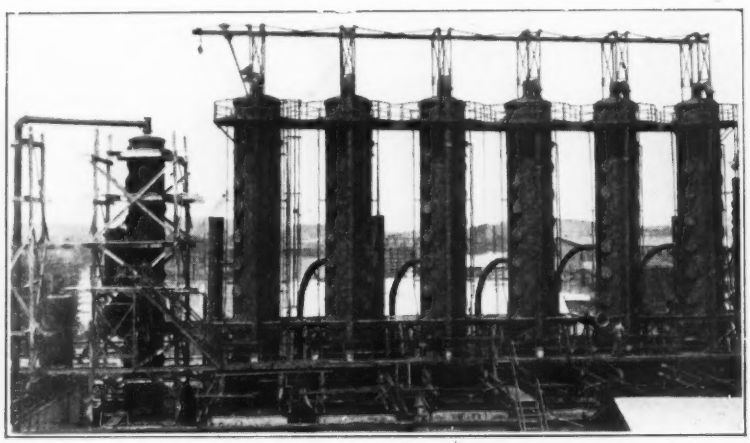

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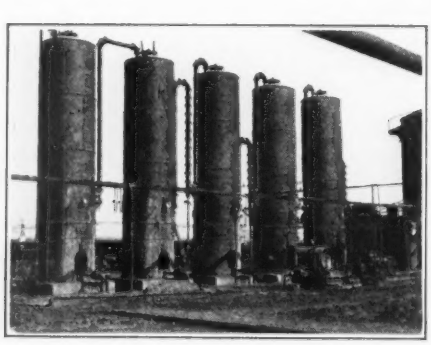

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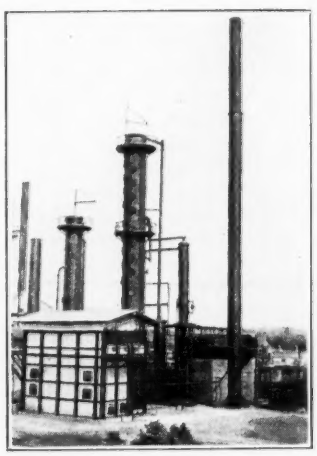

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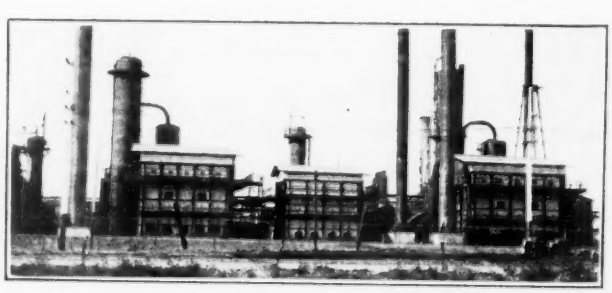

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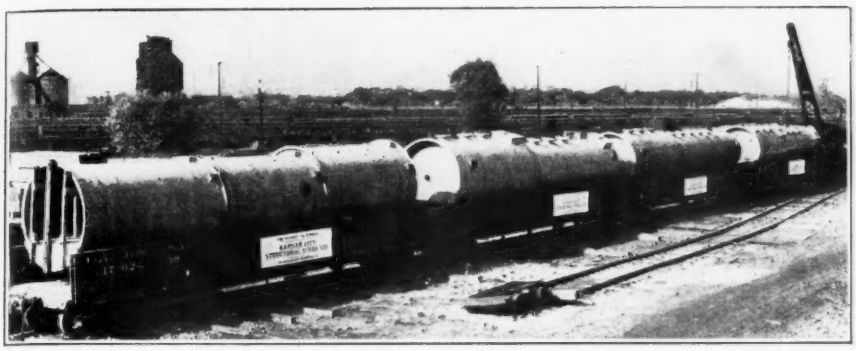

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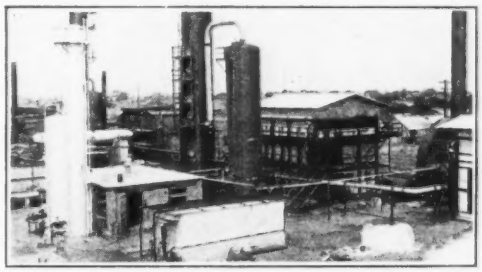

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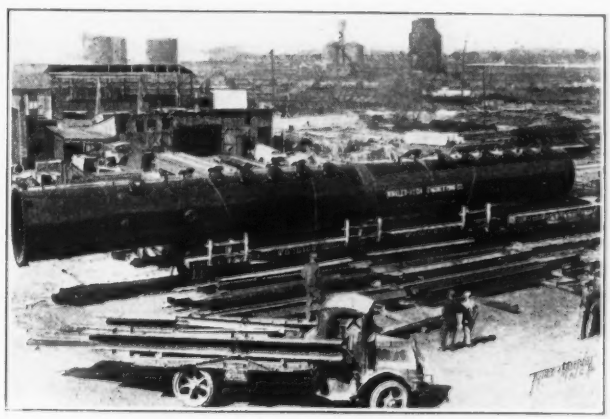

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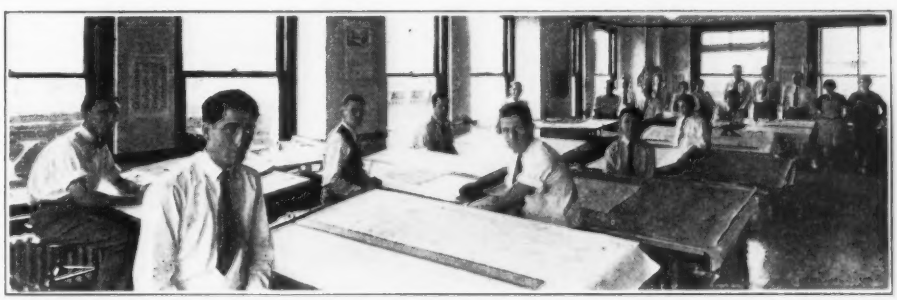

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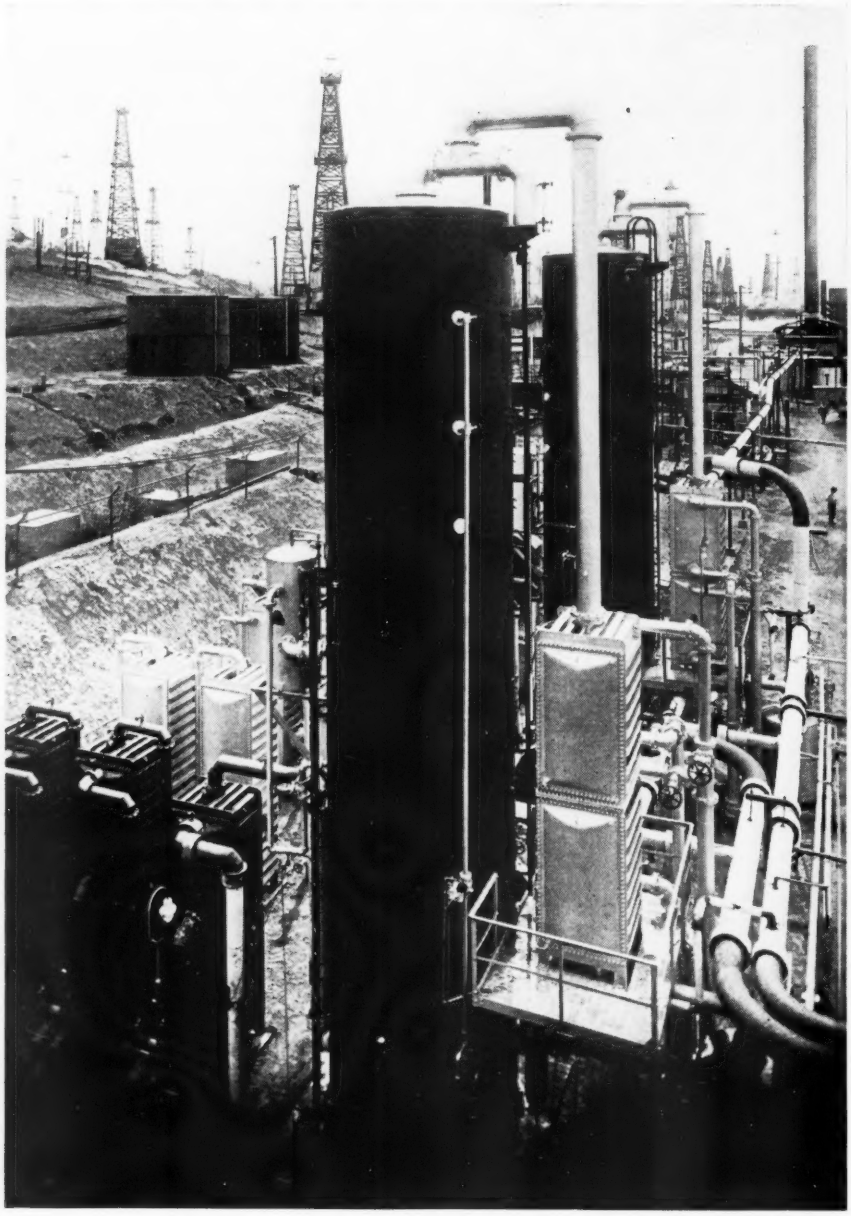

Fig. 5. Fractionating column equipped with single condenser built in two sections. Heat exchangers at left of column

ous trays, or by the use of other types of heating elements.

Although these heaters require live-steam, they permit of its use in the most efficient manner by utilizing the latent heat. The few pounds of steam used in this manner for heating the oil within the still permits of the use of a small amount of reduction steam, which results in an overall saving of steam to the still which cannot be disregarded.

The data shown in Fig. 3 were obtained in a plant where a reboiler, or heating-section, was added to the still portion of the column. Samples of the lean oil were taken just before and after this installation, so that all plant conditions were essentially the same in both cases except that the reboiler raised the temperature of the oil within the still to such an extent that less steam was used in the still itself. The decrease in vapor pressure of the lean oil after the use of the reboiler is quite marked.

The use of heaters in stills is not new, in fact, one equipment manufacturer in 1921 had on the market a still fulfilling all requirements as regards an even temperature throughout the column. Mechanical difficulties, however, encountered with this design, other than the heating element itself, made the venture unsatisfactory and it was eventually dropped, only to be lately revised and labelled, "new." The actual temperatures to be used when operating heating sections will of course depend upon local conditions, and these must be borne in mind in designing the heat-exchange equipment.

The Still Fractionator

The fractionating-section receives the vapors generated in the stilling-section of the column, and hence must operate similarly to any other temperature controlled fractionating column. It must wash out the undesirable oil fractions from the rising vapors, and this is of course accomplished through the action obtained between the ascending stream of relatively hot vapor and the relatively cold descending stream of reflux material. This reflux is obtained from condensations of the overhead-vapors leaving the fractionator.

Now the combined vapors entering the fractionating section carry considerable superheat because of the fact that the steam component is only partially saturated with gasoline vapor. Upon contact with the reflux, this superheat is immediately lost, giving rise to the evaporation of some of the light fractions still remaining in the reflux. Consequently, very little of the oil vapor is actually condensed at this point in the fractionator, but rather the effect may be designated as one of cooling.

This reboiling and cooling effect is of particular advantage to the still section since it results in a reflux there which is practically free of light gasoline fractions. Since these lower trays in the fractionator function without appreciable condensation of the rising vapors on the re-evaporation from this liquid of the very lightest fractions, it is necessary to supply more additional trays than would otherwise be required were all the plates functioning in a strictly fractionating manner.

The Type of Contact Plate

Since efficient fractionation of the gasoline and oil fractions depends upon the efficiency of contact between the liquid and vapor phases, consideration should be given the type of plate employed. The contacting in a fractionator for this particular service is quite exacting, inasmuch as the vapor volume is extremely large in proportion to the liquid reflux, making it necessary to distribute the reflux uniformly over the tray under all conditions in order to obtain the maximum contact with the excessive vapor volume. For this reason, the bubble-plate tray will be found most efficient, since it carries a liquid seal under all conditions of loading.

Incidentally, the term bubble-plate is a misnomer. Bubbling is a poor way to secure contact, because the interior of the bubble does not in any way, except through the surface-film, come in contact with the vapors. The most efficient contacting takes place above the liquid itself, in the form of a fog or mist, which is the result of the vapor velocity carrying or spraying liquid into this space, and in this, the bubble plays only an auxiliary part.

The sieve-plate probably stands next to the bubble-plate for sharp fractionation. The inherent disadvantage of the sieve-plate column is that it has to work under uniform conditions in

order to get the best results. If the column is worked at too slow a rate, the plates empty themselves; if too fast a rate is used, the liquid is blown off the plates. For the same space occupied, packed columns cannot equal the performance obtained from either the sieve or bubble-plate columns, and hence they are seldom used in the newer installations.

The Reflux Condenser

The fractionator section of the column must be operated with a substantial temperature gradient from top to bottom, the lower top temperature being the controlling factor for the end-point of the product. The control of this temperature is effected by the introduction into the top of the column of a reflux material formed from the overhead vapors from the fractionator, which can be accomplished by a reflux condenser operating upon the vapor stream, or by returning some of the finished product to the column.

From a consideration of the theory of rectification, which truth is borne out in practice, proper fractionation can only be obtained when the reflux entering the top of the column is practically of the same composition as the overhead product. This at once precludes the use of either oil or water as a reflux medium; yet it is interesting to note that several such installations were made this year.

Undoubtedly, the use of reflux condensers for producing the necessary wash liquid for the fractionating column predominates at present in the industry. The function of this piece of equipment is to liquefy a considerable portion of the vapors that enter it from the fractionating column and to return it to the column as reflux; the remainder of the vapor passing to the final condenser and cooler.

With a properly designed column, the composition of the vapor and liquid on the top tray are practically identical, and consequently the condenser functions as a condenser. The separation taking place under these conditions in the condenser is undetectable.

Where rectification is not complete within the column, however, the vapor entering the reflux condenser will contain much high boiling material, allowing the condenser to effect a very considerable concentration of these heavier fractions in the reflux.

This is a condition which should not be allowed to exist, since within the condenser the vapors give up heat to the condensate, (reflux) making it impossible to evolve new vapors or to thoroughly contact the liquid with the vapors. Consequently, the condenser is incapable of fractionation, making it necessary for all of this work to be done within the column itself.

A given column, operating under specified conditions, requires a definite amount of reflux, which is the same as saying that a definite quantity of heat must be removed from the column vapors. For another condition of column output, the amount of heat to be extracted will vary, which means that the reflux must be altered. This can be conveniently accomplished by changing either the amount or temperature, or both, of the cooling-agent passing through the reflux condenser. The final boiling-point of the product is thus controlled through the amount of reflux returned to the column.

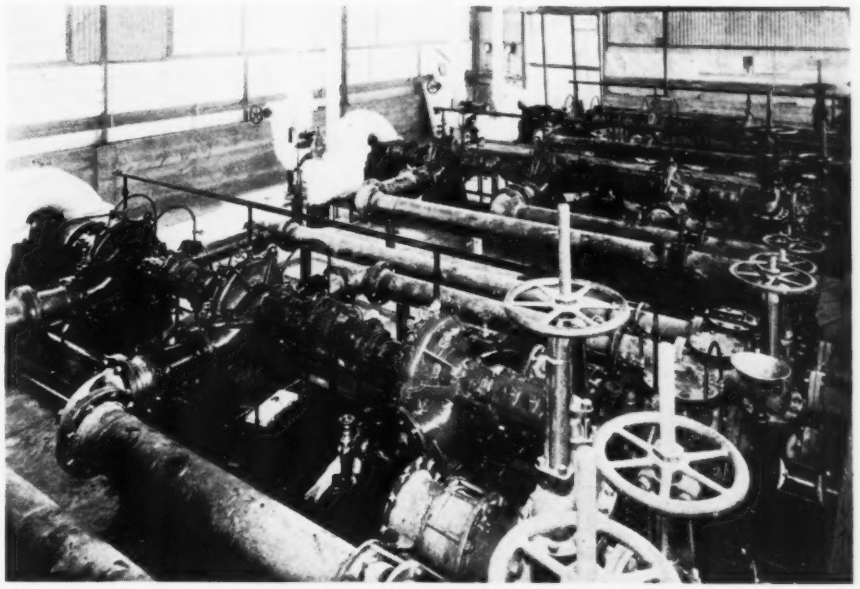

Fig. 6. Centrifugal pumps direct driven from steam turbine as installed in large two unit gasoline plant

The temperature of the cooling medium to the reflux condensers, providing it is below the boiling point of the vapors in transit, has no effect upon the composition of the reflux, although it does affect the amount of cooling-agent required and the design of the condenser. This is true because saturated vapor mixtures, under constant pressure, are not cooled by extracting heat from them but are simply condensed, either partially or entirely.

The liquid produced in this way always contains fractions of all the components of the vapor mixture. There can thus be no advantage in having the cooling agent at the boiling point of the low-boiling constituent with the hope that all of the higher-boiling fractions will be condensed, allowing only the gasoline fractions to pass over to the final condenser.

It is true, however, that the temperature of the reflux being returned to the column should not be below its boiling-point. While such sub-cooling is not exactly detrimental to good operation, it is not economical because excess heat must be supplied from the ascending vapors to raise it to the boiling-point again which is not necessary when only latent heat is removed in the reflux condenser.

Difficulties in Reflux Condensing

The reflux condenser offers the severest cooling problem within the gasoline plant, as well as the distillation unit, because of the higher working temperatures encountered. Considerable scale trouble has been experienced in these condensers where water is used as a cooling medium, entailing much loss in operating time and production. Analyses of numerous such instances results in the conclusion that this difficulty is due to one of three causes, namely:

(1) Operating the condenser in service for which it was not designed.

(2) Operating the condenser at continuous overloads.

(3) Operating the condenser using scale-forming waters.

The first two causes may be disregarded at this time, as they are susceptible to correction through proper design. Regarding the third item, the industry is famed for its universally bad water, a condition which is not tolerated in any other industry employing similar condensing and heat-interchange equipment. Water treatment, together with intelligent operation, will correct the greater majority of the trouble encountered with scaling condensers, and the more recently installed plants using this method of control are proof of this contention.

Because of difficulties with tube-scaling, many reflux condensers are operated with their own cooling-water circuit, in much the same manner as the closed-water system used in connection with engine and compressor jacket-cooling. While such an installation accomplishes all that is desired, the method involves additional plant equipment in the way of coolers and pumps.

Another method used to avoid cleaning difficulties with the reflux condenser is the use of oil as a cooling medium. With this arrangement the necessary amount of rich oil to accom-

plish the desired cooling is by-passed from the heat exchangers. The greatest disadvantage with this system is that it disarranges and throws out of heat-balance all of the heat exchange equipment.

A good deal of trouble has also been encountered with leakage of oil into the vapor side of the condenser, causing difficulty in maintaining the gasoline stream to proper color. Such leakage is facilitated because in most instances the oil circuit is at a considerably higher pressure than the vapor side of the reflux condenser.

A FURTHER method of partial condensing is to use the atmospheric type of coils placed in a water bath, the necessary heat being removed from the vapors by evaporation of some of the water. While scaling may take place here also, it is on the exterior of the tubes, where a partial cleaning can be undertaken without placing the plan itself out of service.

This is probably the only advantage to be gained by this method of control, and even this can be accomplished with the conventional condenser when designed such that various units can be cut out of service for cleaning without disturbing the plant yield. The temperature control of the vapors with this atmospheric type of condenser is not exact, because it is susceptible to atmospheric changes, which disturbs the plant's thermal balance and results in end-point difficulties.

Such apparatus does not respond to correction instantly, but acts more or less sluggish as would be expected since the temperature of the leaving vapor is controlled by the height of water submerging the coils. A very slight change in the water level will produce a large change in condensation, which will immediately alter the still output.

Practically all reflux-condensers are so located that the reflux can gravitate back into the top of the fractionating column. In the majority of cases this reflux is not dehydrated, and this of course should always be done. The quantity of reflux is governed automatically from the outlet temperature of the condenser, and in practically all installations, no means for measurement of this quantity is provided.

Superiority of the Single Condenser System

As has already been pointed out, the composition of the reflux from the partial condenser and the original vapors are practically identical in cases where the fractionating column has been correctly designed, thus offering the possibility of eliminating the secondary or final condenser. In general, the use of a single condenser is to be preferred to that of the system employing a partial condenser.

In this case, the single condenser must condense all of the vapors from the column, part of the total condensate being returned to the fractionator as reflux. An exception to this generalization from an economic view-point is found where the feed to the column is partially heated by serving as the cooling medium to the reflux condenser.

With the single-condenser system the required amount of reflux is returned to the column by means of a pump, making it exceedingly easy to control the temperature of the vapors leaving the fractionator such that the desired end-point gasoline is produced. It will be remembered that the reflux returned to the fractionator controls the characteristics of the finished gasoline.

The pumping charge is exceedingly small for this service, since the head upon the pump is low, consisting chiefly of friction drop through the lines and the automatic control valve. The fact must not be ignored, in controlling the end-point of the product in this fashion, that a considerable saving in upkeep cost on a reflux-condenser is effected, which in the average plant is an item of considerable magnitude.

It is of course not necessary to return the reflux by pumping, for the condenser can be placed in such a position that gravity can be utilized in the conventional manner. Other things being equal, however, there is some advantage in having the condenser placed at the ground-level for purposes of accessibility, and the flexibility given the system by the use of a pump more than offsets the pumping cost.

At the risk of repetition, and in order to emphasize the desirability of returning the reflux by pumping, consider again the fractionating column. For any given column and condition of input, there is a certain reflux ratio which will give optimum fractionation in the column. Should the reflux be less than this amount, the output from the column will not have the desired characteristics because separation will not be sharp.

IF THE reflux is greater than this amount, the degree of fractionation will have been increased somewhat, but the improvement in the product itself will be so slight as to not warrant the increased cost of operation. The use of a pump, especially in connection with the automatic rate controllers now available on the market, permit the reflux rate to be so adjusted and controlled that a reasonable approximation to the optimum condition may be obtained at all times.

Inasmuch as the vapors leaving the top of the fractionator, with the single condenser system, have been cooled to the required temperature for final condensing by the return reflux, the final condenser handles lower temperature vapors than does the reflux-condenser. This is especially true for the common case where the partial condenser effects a considerable separation of the vapors. The single condenser thus operates with a lower maximum working temperature, making the use of water as a cooling-agent much less of a hazard than in the case of the system using a reflux condenser.

Trouble from scale is practically eliminated because of this lower vapor temperature. In spite of the less likelihood of scale formation, the atmospheric type of condenser lends itself more efficiently to the single condenser system than it does to the partial condenser arrangement. This is true since the function of the condenser here is to condense and cool the incoming vapors to the lowest extent, there being no necessity for governing the outgoing temperature of the condensate and vapors as in the case of the partial condenser.

WHEN a single condenser is used it must be adequate for condensing the reflux as well as the finished product. As the reflux is the finished product, this amounts to a required condenser capacity of about three times that required for the production alone. The fact that a considerable portion of the finished product is recycled in this manner is no disadvantage, since it improves the efficiency of condensing over that obtained in the normal plant. This condition exists because the proportion of the heavier fractions in the final vapors, relative to the lighter fractions continuously distilled from the oil, is greatly increased over usual practice, making condensation much less difficult.

Just as it is desirable in the case of a partial condenser to return the necessary reflux to the column at the highest possible temperature, that is with no sub-cooling, so it is with the single condensing system. This fact makes it necessary to divide the single condenser into two sections, the first removing only the latent heat from the vapors, and the second section, acting as a cooler for the product not returned to the column as reflux. The reflux is thus the required portion of the warm condensate from the first section of the condenser.

Such an arrangement, by proper proportioning of the two sections relative to each other, facilitates the removal of the condensed steam, making it possible to return a water-free reflux to the column. When dividing the condenser into sections as just discussed, it is readily possible to still obtain the desired condensation even when using a portion of the feed as a cooling medium in the condensing-section, using water only in the second-section. When this is done, the highest economic efficiency is obtained.

Effect of Steam Condensation With the Fractionator

The only consideration given the reducing steam so far in the discussion is that it leaves the fractionator only partially saturated with gasoline fractions. As a matter of fact, a considerable portion of this steam may be condensed in the fractionating section due to the temperature gradient through the column. Water so condensed in this fashion will migrate through the column with the reflux, being re-evaporated as it finally reaches the warmer portion of the fractionator.

In certain instances, where fractionation is poor and the temperature of the overhead vapors must be held relatively low in order to prevent absorption oil going into the finished gasoline, this condensed water has actually been known to enter the still-section along with the reflux. Under such conditions the re-evaporation of this water has caused operating difficulties of considerable magnitude.

Even where the condensed steam does not interfere with operation, it does affect the fractionating efficiency because it requires heat from the rising vapors for evaporation which should rightly go towards re-evaporating the lighter gasoline fractions on each tray. When such condensate is reboiled to again form steam, the resulting partial pressure effect is such that the boiling point of the gasoline fractions are reduced, allowing the heavier oil fractions to leave the fractionating section at a top temperature which under conditions of a water-free reflux would produce an oil-free product.

While it is readily understandable that water condensing in the upper portions of the column will destroy the fractionating efficiency, the methods for its prevention are few and difficult to apply. The first scheme to occur to one is to use dehydrators on the column, placing them at various points so that the reflux containing water will be freed of its water content, allowing the pure reflux to continue on its way downward through the tower.

While such arrangements sound simple at first thought, nevertheless dehydrators of this nature have not always been a mechanical success, and in fact, have been a source of some annoyance whenever used. Other than this fact is the major difficulty of the correct location for such arrangements. It must not be overlooked that the column temperatures and pressures actually used in the field are in most cases at considerable variance with the conditions selected for design purposes.

Consequently should the operator decide to increase the distillation pressure, the steam will be found to condense out at a lower point in the column, and for this reason, it is general practice to locate a dehydrator just above the feed-plate in order to act as a safety-means for keeping water out of the stilling section. Should the column pressure be lowered, then the water will settle out at a higher point in the column, making the original dehydrators useless for immediately removing the condensate as formed.

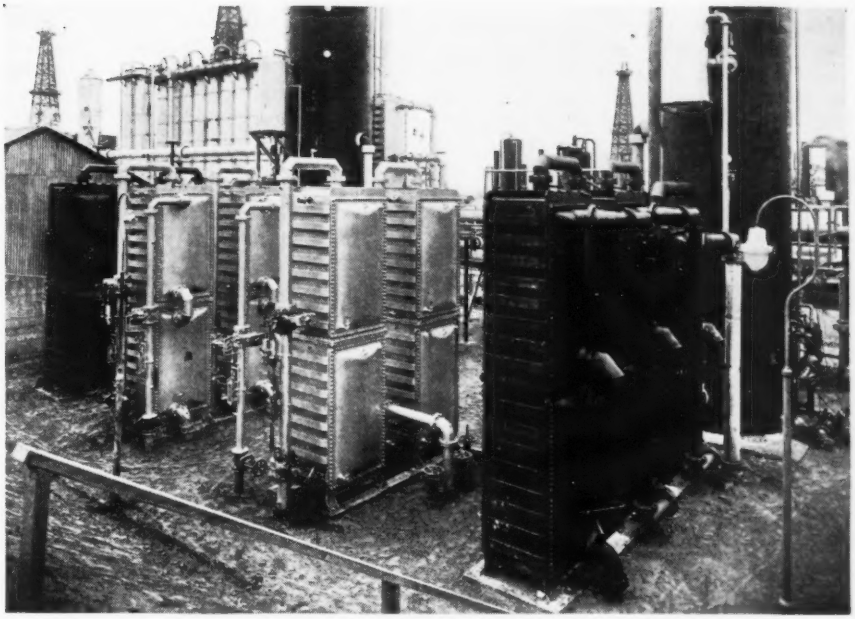

Fig. 7. Bank of modern heat exchangers in gasoline plant

These facts seem to point to another advantage in operating the distillation unit at low-pressure, and that is, by designing the unit originally for such operation, the reduction-steam will all pass overhead to the partial or single condenser, depending upon which is used, thus eliminating trouble with condensing steam within the column.

Another thought along these lines is that the entire column should always be insulated, regardless of the operating pressure. This is necessary since condensation of the vapors within the column is promoted by radiation of heat from the shell walls between trays, and such a form of condensation is detrimental to efficient rectification.

Still another method for ridding the fractionator of the evil of condensed steam is to use a combination of distillation and condensing pressures. This can be accomplished by operating the first fractionating column at relatively high pressure, as 45 to 50 pounds, in connection with a bottom reboiler. Such a column receives the enriched oil from the preheater, as usual, but as no reduction-steam is admitted into the base of the tower, there can be no difficulty from condensing steam in the fractionating section.

For reducing the boiling points and helping to flash the various gasoline fractions from the oil, vapors taken from the hot-rich-oil exchanger are used in lieu of the customary steam. Such vapors will vary in composition for each installation, but in general the percentages of propane, butanes, and pentanes and heavier will be approximately equal and totaling 75 per cent by volume. The overhead vapors from this column are handled in the usual manner, finished gasoline being used for end-point control.

The partially denuded rich-oil from the high-pressure fractionator then flows to a low-pressure still, employing reduction steam, where the vapor-pressure of the oil is reduced to the desired point again for absorption. The vapors so removed are of course composed of steam and the greater percentage of the heavier gasoline fractions originally removed from the rich-gas.

As this gasoline is exceedingly stable, little difficulty or loss results from condensation at two to four pounds, which is the operating pressure on the still itself. No outside reflux is used for controlling the end-point of these vapors, this being cared for by the amount of reduction-steam used and the ensuing natural reflux.

This low-pressure gasoline is then dehydrated and preheated to the necessary temperature for re-introduction into the high pressure fractionator. The point of injection into the column is at a point somewhat above the oil feed, but below where the finished gasoline is introduced for end-point control. Such a system gives the advantages of high pressure condensation, as well as effective stripping of the oil at low-pressures, without the annoyance of condensed steam in the rectifying section of the unit.

Steam to Column Should Be at High Temperature

Two schools of practice have sprung up in connection with the reduction

steam used in the stilling section of the column. The one employs high pressure plant steam expanded through a valve to the still pressure, while the other operates the pumping equipment at sufficiently high-back-pressures such that the exhaust steam may be utilized in the still. Both methods are incorrect as practiced.

The expansion of steam without doing mechanical work is obviously unsound economically. Besides, in order to have the temperature of the expanded steam equal to the 320 F. temperature oil found in the lower section of the average still operated at 30 pounds pressure, it is necessary to have available 200-pound dry-steam prior to expansion.

Actually, only the more recent plants have this pressure at hand, and in most instances, even with the use of a separator the steam will be found to contain 1 per cent moisture, which will reduce the temperature after expansion to 310 degrees. As most plants operate with 125 pounds, the temperature of the expanded steam to the still will be of the order of 299 degrees. In the column this steam will be super-heated, the heat required for this purpose being of course furnished from the hot oil. This effect naturally lowers the still temperature, and low temperatures within the still have already been shown to be highly undesirable.

On the other hand, the use of exhaust steam obtained from pumps is to be avoided in the still because of the large quantities of moisture and lubricating oil which it contains. This is true even of pumps operating on totally dry initial steam.

The use of a steam separator before the still will remove but a fraction of this moisture, to say nothing of the oil, consequently a cooling effect as above discussed exists in this case too, with the added fact that the absorption oil is subject to contamination further by means of the oil. When turbine driven pumps are used, the oil factor does not exist.

There is no doubt that the exhaust method of supplying the reduction steam is correct, providing certain modifications are made as to its utilization. First, the steam temperature should be equal to, or higher, than the temperature of the oil within the still, and this effect may be obtained by reheating. This can be readily accomplished by using the plant high pressure steam as a heating medium, and this same method should also be employed for heating throttled high-pressure steam to the still in instances where such a system must still be used.

Another method of reheating is to pass the low-pressure exhaust or throttled steam through a superheater prior to entry into the still, this arrangement lending itself to supplying reduction steam at temperatures considerably higher than those within the still. Without doubt the most desirable and economic system is to use turbine-driven pumps, supplying the prime-mover with initially superheated steam which will give a superheated exhaust steam for the still without additional reheating. Any one of these methods is vastly superior to attempting to let the still-reboiler furnish the necessary heat for drying the reduction steam.

Regarding the relative merits of superheated over dry-saturated steam in the still, it may be concluded that the two are on a par as far as reduction properties are concerned, provided the temperature of both is higher than that of the oil. Doubtlessly under some conditions the superheated steam might show a greater resistance toward promoting emulsions in the oil than would be the case for the dry-steam.

Location of Feed-Plate

The enriched oil feed from the preheater should in all cases be entered into the column at a point between the stilling and fractionating sections, and not into the upper portion of the tower as it sometimes done. The temperature of this feed should be such that thermometer readings taken from each tray within the fractionating section will indicate that the temperature gradient is uniform, and that the feed is not producing a cooling effect upon the feed-tray.

It will thus generally be found necessary to have the feed temperature somewhat higher than the temperature of the liquid on the feed-plate in order to compensate for the flashing of gasoline fractions from the oil upon entrance into the column. This requires that the preheater supply the necessary sensible heat to the oil to accomplish this flashing or evaporation of the gasoline fractions.

Automatic Control Necessary

Better results can always be obtained from a column when all pressure and temperature conditions are constant. These conditions are more easily acquired when the feed-rate is constant, and this point of operation cannot be overemphasized. Centrifugal pumps are much superior to the ordinary plunger pumps in that they assure a smooth and non-pulsating flow of oil. The better practice is to set the feed-rate to the distillation unit constant, allowing the necessary variation in flow to take place between the absorber and the feed-pump suction.

The use of automatic controls is to be encouraged, and even the newer plants are not perfect in respect to metering and control equipment. The feed-rate to the column can be maintained constant within an uncanny degree of accuracy by the use of a differential flow-controller operating upon the principle of the utilization of the differential pressure drop across an orifice plate.

The steam to the still should be likewise maintained uniform, but here the rate must be proportional at all times to the feed-rate. A regulating device is now on the market which will give such results with as high degree of efficiency as in the case of the rate-controller. The temperature of the vapors leaving the column affords the means of controlling this temperature through the use of the conventional automatic temperature controller.

Recording meters are essential for obtaining the oil, reflux, and steam rates to the column, while at least the vapor temperature to the final condenser should be recorded. It is also very desirable to meter the uncondensed vapors leaving the unit through the automatic back-pressure valve.

All such control devices should be located at an elevation readily accessible from the ground, and should be equipped with the necessary by-passes. Probably no end of the distillation unit is more overlooked than this controlling equipment, and it is only necessary to step into the average plant to find that it is devoid of means for ascertaining the performance and efficiency of the unit.

Such devices, aside from giving this information, actually place the unit under the control of the superintendent or engineer responsible for the plant, and who is much better qualified, or who should be, to decide upon the correct operating conditions rather than the various operators. The industry must take a leaf from the book of the central-station power plant in this respect.

Future Development

Summing up, it is apparent that the stilling-column must be capable of handling and keeping in proper condition the light type of absorber oil if the rest of the plant is to operate at its maximum efficiency. The column is without doubt the heart of the distillation unit. The next few years will undoubtedly see considerable improvement in this vital unit, for such development always closely parallels the development of testing practice, and the still has heretofore been particularly handicapped by the absence of definite and dependable testing procedure.

It is now realized that a better method of determining the condition of the lean absorption oil is required than the ordinary distillation, which often shows a high gasoline content for a low vapor pressure oil, or a low gasoline content for a high vapor pressure oil. As it is the vapor pressure of the oil which controls the absorption, the still must necessarily be governed from this phase of the problem, and at present, rapid strides are being made toward determining this characteristic of absorption oils.

Producing Section

ENGINEERING PRODUCTION IN 1929

By J. B. Umpleby*

Problem of Crooked Holes Solved—Better Steels and Alloys Considered to Lighten Drilling Equipment—New Methods Found for Tubing High Pressure Wells—Pumping Technic Improved—Repressuring and Pressure Maintenance Further Studied.

J. B. Umpleby

PRODUCTION engineering in 1929 has been characterized by noteworthy advances in many lines rather than by marked innovations in any particular line. The place of the engineer in the industry has become more firmly established through wider recognition of his service by executives and the more complete pooling of his experience through technical organizations, the trade journals and field conferences. The engineer is coming to view his recommendations not only in the light of operating efficiency but also in the light of economic consequences and thus his counsels are more welcome and his conclusions bear greater weight.

Operating Technic

Drilling: The year has by no means lacked in specific accomplishments. The problem of crooked holes in rotary drilling was generally recognized and solved, all in a period of about 18 months. One year ago the average vertical correction necessary in the Seminole area was probably about 125 feet; now it is less than 25 feet. What was then a problem of crooked holes has now become the technic of drilling straight holes. The result has been accomplished by stipulating in drilling contracts a maximum permissible divergence from the vertical—at first by 10 to 15 degrees and more recently as low as 5 degrees.

Engineering study made this possible by establishing the fact that excessive weight on the cutting face caused flexure. Knowing this and with income dependent on the completion of reasonably straight holes, contractors and drillers in large part solved the problem. Much effort on the part of engineers has been devoted to designing mechanical devices that will eliminate the human equation in controlling bit pressure. These range from special crown blocks with hydraulic control, through gauges attached to the wire line, and automatic brakes on the draw works, to a cut off unit set in the drill stem at such distance from the bottom that, when the permissible pressure is exceeded, circulation stops. It may be confidently expected that some simple automatic device will be found and generally adopted.

Rotary drilling technic has been further advanced by greater care in the selection of rotary muds. This has been particularly true in California, where deep holes penetrate poorly consolidated formations.

The tendency to increase the size and weight of rotary equipment is now being questioned and many engineers are giving thought to better steels and alloys to the end that lighter machinery may reduce operating costs. Efforts to reduce drilling costs have also directed much study to the development of bits that will give greater footage between changes. The increasing depth of wells makes the changing of bits an increasingly costly item. Consequently tempered steel is giving way to diamond substitutes and to resistant material welded to the cutting face. These have several times the life of former bits and hence greatly reduce the time required for deep well drilling.

It has long been recognized that faster cutting speed could be attained either by increased pressure on the bit or by faster rotation. For some years the tendency has been toward increased pressure because of the limitations of bit material and design. With the increasing use of alloy steels of great hardness and heat resistance engineering opinion seems to be turning to higher speed of rotation and lighter equipment. There is much reason for believing that straighter holes would result and drilling time be greatly reduced.

In standard tool drilling there has been no marked changes in general practice, although the more general adoption of American Petroleum Institute standards has undoubtedly both reduced costs and increased efficiency. Continued improvements have been made in core taking devices and the torpedo type of bit has come into more general use in caving ground.

An interesting accessory device permits of photographing the interior of a well. If this technic can be sufficiently developed it will undoubtedly have many uses. Along the same line an electrical device for measuring the relative conductivity of beds penetrated by the drill has been developed abroad and seems to offer possibilities in correlating formations and particularly in determining the position of oil saturated beds in rotary drilling.

Bringing In Wells: The higher temperature and higher gas pressure accompanying deeper production have led to many changes in equipment and methods. Much study has been given to cement mixtures in setting casing, but the actual advance in knowledge on the subject during the year has been less important than the wider dissemination of approved

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procedure. A noteworthy innovation, however, is the use in California of large quantities of ice to facilitate setting cement in deep wells by temporarily reducing bottom hole temperature.

The use of lubricators for killing gas has been largely extended and the specific gravity of mud mixtures given special attention. The floating in of long casing strings has become common practice.

Methods of tubing high pressure wells have been developed to a point where any known pressure can be controlled and the well tubed with almost no loss of production. Manually operated rams close firmly about the tubing alternately below and above tubing collars snubbed past them. Tubing is run at the rate of approximately 200 feet an hour.

Flowing Wells: The subject of flowing wells has received intensive study during the year. The central thought has been to reduce the gas-oil ratio on the one hand and prolong the flowing life on the other. Beaning and back pressure is used in the case of large wells and flowing through tubing, in an effort to reduce slippage, is being tried for smaller wells. It has been found that flowing through tubing in most cases does not reduce the gas-oil ratio although it does prolong the flowing life.

These methods would undoubtedly be more generally applied were it not that competitive conditions dictate the necessity of maintaining maximum daily output. Consequently gas lift is commonly resorted to during what would otherwise be the later stages of the flowing life. Under unit operation the practice of holding gas-oil ratios to a lower level and prolonging the flowing life of wells by stepping down the size of flow strings as pressure declined would in all probability become common practice.

Air-Gas Lift: Improvements in air-gas lift practice have continued as experience increases. The intermitter has come into general use and many of its imperfections corrected. A device for automatically relieving pressure from the sand face between flows has been designed and is said to be giving satisfactory results. A procedure combining pumping and gas lift has been adopted by one company for small wells in the Seminole field with a noteworthy increase in output.

The most important contribution to this subject, however, results from a searching questionnaire on Seminole practice that formed the basis of a special Mid-Continent meeting of the A. P. I. Division of Development and Production Engineering. This work brought together the combined experience of all operators and was freely discussed by engineers, superintendents and farm bosses. It is now available to the industry as a special report.

In passing, the A. P. I. division should be congratulated on the direction its activities are taking. Equipped as no other organization for collective investigation and effective recommendation to the industry, it is concentrating its effort in this direction with outstanding success. The reviewer believes that summaries of operating practice with the attendant pooling of experience will in the end have even greater value to the industry than the standardization of equipment which because of its importance marked a new era.

Pumping: Perhaps the greatest advances of the year in production engineering have been made in pumping technic. Dynamometer studies have continued to throw much light on pumping efficiency and causes of rod and equipment failures. The tendency has been toward slower motion and longer stroke. Perhaps extremes have been reached in the Salt Creek Field where as low as three strokes per minute are being used with resultant reduction in equipment trouble. Each well, however, continues to be largely a problem unto itself.

Counterbalancing has been further studied, with the conclusion that the smoothing of rod motion is perhaps as important as the obvious saving in power. Also important is the reduction of impact loads.

Experiments have gone forward in an effort to apply the power for lifting oil at the bottom of the well. In the abstract it is absurd to move 4000 feet of rods in addition to the fluid column. Electricity, compressed air, and hydraulic pressure each seems susceptible of application at the bottom of the hole and each has been tried variously. If the problems of satisfactory insulation and packing can be solved, electric bottom hole pumping seems at present most promising.

Notable advance has been made in the handling of caving and floating sand wells through a procedure developed in Kansas. Here a shot hole is filled witht gravel through which a liner is set by allowing it to follow down with slowly moving standard tools.

Other Items: Advances have been made in studies of corrosion; pipe line maintenance and pumps; electric and acetylene welding of joints, with data apparently accumulating in favor of the former; gas separators, pressure gauges and controls; handling refractory oils both above and below the ground; sub-surface storage of gas and many other items too numerous to mention in a brief review. In all of these fields progress may better be termed progressive rather than revolutionary.

Larger Problems

Gas Energy: The conception of gas energy as the chief force in moving oil through the sand, long recognized by engineers but first brought forcibly to the attention of the industry in 1927, has become a dominant factor in the determination of major policies.

This is shown by the gas conservation law of California, increased activity of Conservation Commissions, Government attitude, the policy of individual companies and the discussions in the technical press and organizations. The determination of gas-oil ratios has become common practice and a principal measure of operating efficiency.

Only a few years ago it was estimated that for every barrel of oil produced, gas energy was robbed from between three and four other barrels of oil. It is not surprising that, with this magnitude of margin to draw upon, much attention has been given to the matter. Consequent upon general acceptance of the gas energy concept is a growing recognition of the fact that the energy stored in an oil pool is to a large extent the common property of all operators in the pool; that extravagance on the part of one is an injury to all the others.

Also consequent upon the concept, leaders of the industry have come to accept the operation of pools as units as being economically sound, promising largely increased profits by reason of cheaper operation and increased recovery, and affording the most effective means of national conservation. In fact, the chain of consequences leading back to the general acceptance of the role of gas energy in producing oil is changing the whole trend of the petroleum industry in the United States. In no year have these changes been so apparent as in 1929.

Repressuring and Pressure Maintenance: Repressuring has not received the attention in 1929 that it did in certain previous years because of the excess production from many new and low cost fields. In the Bradford field intensive water flooding, introducing water from the surface under pressure, has proven more profitable.

Growing experience indicates that the price of crude oil must warrant the added expense of repressuring on an expectancy of from 200 to 600 per cent increase before the operation is profitable under average conditions. In California, however, other factors enter. Under the new gas law excess gas must be marketed or stored, and repressuring seems to offer a profitable means of storing, turning what would otherwise be a liability into an asset by reason of increasing the recovery of oil and the recoverable amount of gasoline in the gas.

Pressure maintenance is becoming more common because of a local supply, the increased flowing life of wells, and the wider acceptance of the view that, in the absence of agitation, it is easier to maintain the energy system than to build it up when it has once run down. Again it is necessary to refer to the California gas law because a logical consequence of this will be pressure

maintenance throughout that territory. For several years engineers have urged pressure maintenance upon the industry, but the individual operator has been reluctant to give up a well for use as an intake, particularly in its flush stage. Furthermore, the division of a pool by property boundaries places an unfair burden upon the progressive operator, and agreement on methods is difficult of attainment.

Unit Operation: No fundamental idea has swept the oil industry more rapidly in recent years than that of operating oil pools as units. In 1927 the directors of the American Petroleum Institute declined to recommend this procedure. A year later they passed a resolution recommending it. During the current year the Petroleum Division of the American Institute of Mining and Metallurgical Engineers studied the problem of well spacing as an item in unit operation programs. More recently it became apparent that the industry was largely in agreement with the general idea but needed concrete facts and such measure of its advantages as was possible in order to make the agreement unanimous and capable of presentation to royalty owners and small operators.

It was pointed out that foreign fields, in most cases parts of large concessions, were mostly operated as units and that perhaps 25 unitized pools existed in the United States. To collect and analyze the data from these areas is a special problem undertaken by the A. I. M. E. group for their February meeting. A closely related problem being studied for their December meeting by the A. P. I. Engineers is pressure maintenance. Later should be taken up the problem of distribution of wells on a structure, the sequence and rate of drilling them, etcetera.

With the outstanding fact that the individual pool is the one natural unit given to the oil industry it is not strange that opinion is swinging rapidly toward treating it as such. The migratory nature of oil and the fact that gas drawn from one part of the reservoir robs energy from all other parts makes it obvious that divided ownership can only encourage waste, added expense, disturb the market structure and thwart engineering effort toward proper development, efficient operation, maximum ultimate recovery and the many benefits of long time planning. Under unit operation pressure maintenance, for example, would be standard practice.

One leading executive who has studied unit operation exhaustively at home and abroad, made the statement publicly that he would rather have 50 acres under unit operation than 100 acres in the same pool under competitive conditions. The advantages to the operator are perhaps greater than to the royalty owner but even he will reap large benefits through reduction of risk, stability of income and largely increased recovery per acre.

While proration, if seriously contested, would, in the opinion of many attorneys, be adjudged in restraint of trade and illegal, the operation of pools as units, where the prime consideration, at least from the royalty owners' standpoint, is increased recovery per acre, is a conservation movement in the truest sense of the word. The reviewer believes that all other considerations apart, the expectancy of increased ultimate recovery alone abundantly justifies unit operation and development of pools. It has the possibility of from 50 to 200 per cent benefit. A measure of possible benefit is indicated by the results of reclamation methods in many fields.

At Bradford average recovery by old methods was 3000 barrels per acre. Twice this much is recovered by water flooding. In many cases repressuring has doubled ultimate production. At Pechelbron and Wietz three times as much oil drains into tunnels as was taken from wells during a half century of operation. Furthermore, competition of foreign fields operated under unit conditions will force unitization upon our own industry if we are to hold a place in foreign markets. In numerous foreign areas there is much more oil proven but not being drawn upon than is commonly recognized. Sir John Cadman points out that in justice to the people of those countries a permanent outlet must be found for a reasonable part of that large potential output.

Summary

In summary the year 1929 has been notable for a weeding out of ideas and a much more general acceptance by the industry of those that have stood the test of exhaustive discussion and analysis. This applies not only to problems of engineering practice but also to the large problems of the industry.

The standardization idea started some years ago has passed on from items of equipment to methods of drilling, operating and the handling of major problems. Fundamental to all this is the pooling of experience and knowledge and never has this been more fully and freely done than during the present year.

Drilling Deep Wildcat in Germany

CLEVELAND, Oct. 20

ONE of the most important developments now proceeding in Germany is the quest for oil in quantity over a concession the state of Oldenburg, held by the North European Oil Co.

The first well is about three miles west of the village of Brake on the Weser river. Though backed by the best geological knowledge, it is in all respects a wildcat well and it differs from all other wells in Germany inasmuch as it is being drilled according to the latest ideas of American practice and experience.

It is a rotary drilled well and according to latest reports, has reached a depth of 1945 feet and is in the greenish gray shale of the lower Eocene. The well is being operated by an American crew under the supervision of L. Hansen and the most modern machinery is being used. The derrick is one of the standard Ideco derricks manufactured by the International Derrick & Equipment Co., of Columbus, Ohio. The drawworks and rotary equipment were made by Alfred Wirth & Co., Erkelenz; the drill pipe is supplied by the National Supply Co. and Hughes rock and fish-tail bits are being used.

Among the other equipment is a small type mud hog manufactured by the Oil Well Supply Co., while the casing is Mannesmann. If necessary the well is to be drilled to 5000 feet, but present indications are particularly favorable and an average of about 50 feet of hole is made per day, every foot being cored.

The drilling crew operates in 38-hour shifts and all the members have had experience in deep drilling in California, the Mid-Continent and other American fields where wells frequently come in under high pressure.

The resident geologist of the North European Oil Co. is K. F. Hasselmann, formerly with the Standard Oil Co. of California. The North European Oil Co. is a Delaware corporation. Its president is Chester Naramore; vice-president, John W. Campbell, and the other directors include Ralph Richardson, Frederick Y. Robertson, Phillip W. Russell and Dr. Arthur C. Veatch.

NEW YORK—The Second International Drilling Congress held in Paris, Nancy, Strasbourg and Pechelbronn from Sept. 15 to 23, was attended by Frederick G. Clapp, consulting geologist and petroleum engineer of New York and Paris. Mr. Clapp attended as a delegate of the United States government, of the National Research Council and the National Academy of Sciences. A number of papers on oil, drilling, geology and geophysics were presented at the meeting, and the oil wells and mines at Pechelbronn and vicinity were visited.

Development of the Gas-Lift In Seminole Field

By S. F. Shaw*

OIL was discovered in the Seminole field in the spring of 1926, since which time there has been produced 368,000,000 barrels from that field. The peak was reached in July, 1927, when a production slightly greater than 525,000 barrels per day was made.

Of foreign countries aggregating a greater production than Seminole there can be mentioned only Russia, Mexico, and the Dutch East Indies, with Roumania not far behind.

The greater Seminole area may now be considered as including Bowlegs, Carr City, Earlsboro, Little River, Maud, Mission, St. Louis, Searight and Seminole City pools.

Production of one of the principal companies in the Seminole field has been as follows:

Year	Total barrels produced
1927	20,068,000
1928	11,870,000
1929 (6 mos.)	5,909,000
	37,847,000

Produced on gas lift	Per cent on gas lift
12,217,000	61
8,783,000	74
4,629,000	78
26,629,000	68

The first work that was done in the Seminole field by means of the air-gas lift was in October, 1926, and consisted in running a tubing into the well and flowing the well into a central trap, or separator, some distance from the well.

Later practice involved the use of the separator close to the well, elevated so that the oil would gravitate to the tank battery, the gas from the separator being returned to the compressor plant for extraction of gasoline. Gradually there has developed a technique as regards operation of gas-lift wells which takes the operation out of the guessing stage and substitutes daily reports and regular well testing to determine the manner in which the wells should be operated.

Use of Gas Meters

The oil is lifted to best advantage where the proper amount of gas to perform the lifting operation is employed. In order to know the quantity of gas that is being consumed it is necessary to use meters both on the input to the well and on the discharge from the well. Those companies employing these two sets of meters appear to have the greater success in gas-lift work.

In addition to the installation of meters, there must be daily collection of the charts from the meters, and the quantities of gas should be computed daily in order that reports can be made of the quantity of gas entering the well and the quantity of gas leaving the well. The difference between these two quantities is the quantity of gas coming with the oil from the sand.

The quantities of gas per barrel computed by one of these companies for the three past years are as follows:

Year	Gas input per bbl.
1927	1213
1928	2762
1929 (6 mos.)	2650

Gas output per bbl.	Gas-oil ratio
1805	592
3895	1133
3600	950

Whenever the daily production shows any pronounced change it is the usual procedure to examine the charts from the meters before anything else is done. Some farm foremen have acquired the habit of tabulating the data on the charts and comparing the chart figures with those of previous days when searching for the source of trouble before sending the charts in to the office for computation of volumes.

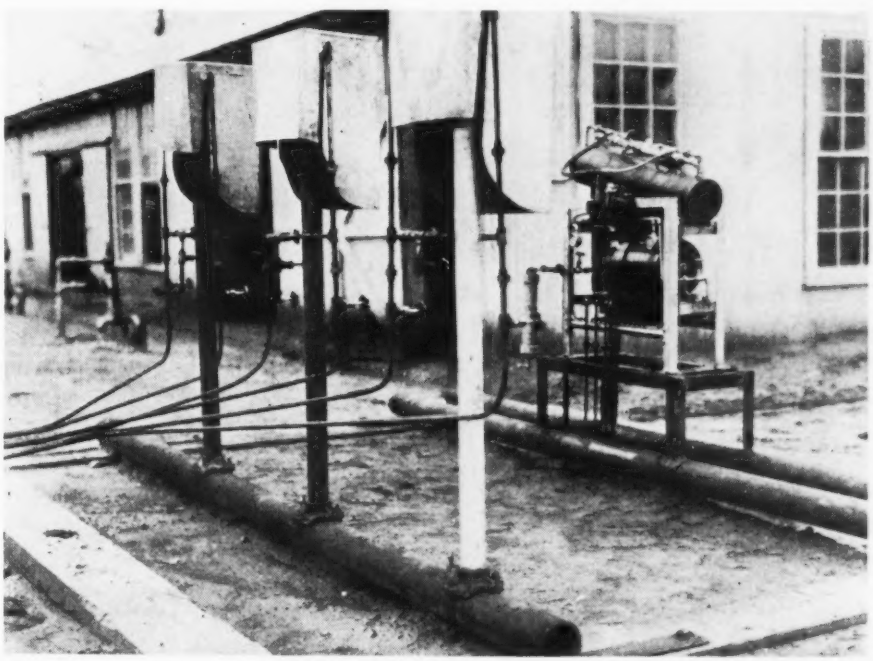
It has been found that the use of excessive volumes of gas may cause a loss of production as well as the use of insufficient gas, and the farm foreman can ascertain whether such a condition exists by examining the meter charts.

Volume Control Devices

Various types of devices have been tried out for controlling the flow of gas to the wells, but in most cases these have gradually been displaced by gate valves or stop cocks which are "pinched" to control the flow of gas.

Considerable difficulty was encountered by reason of corrosive gases attacking the controls and in time rendering them inoperative. Pinched valves leave much to be desired, but are the simplest means yet found to use where common header systems are employed.

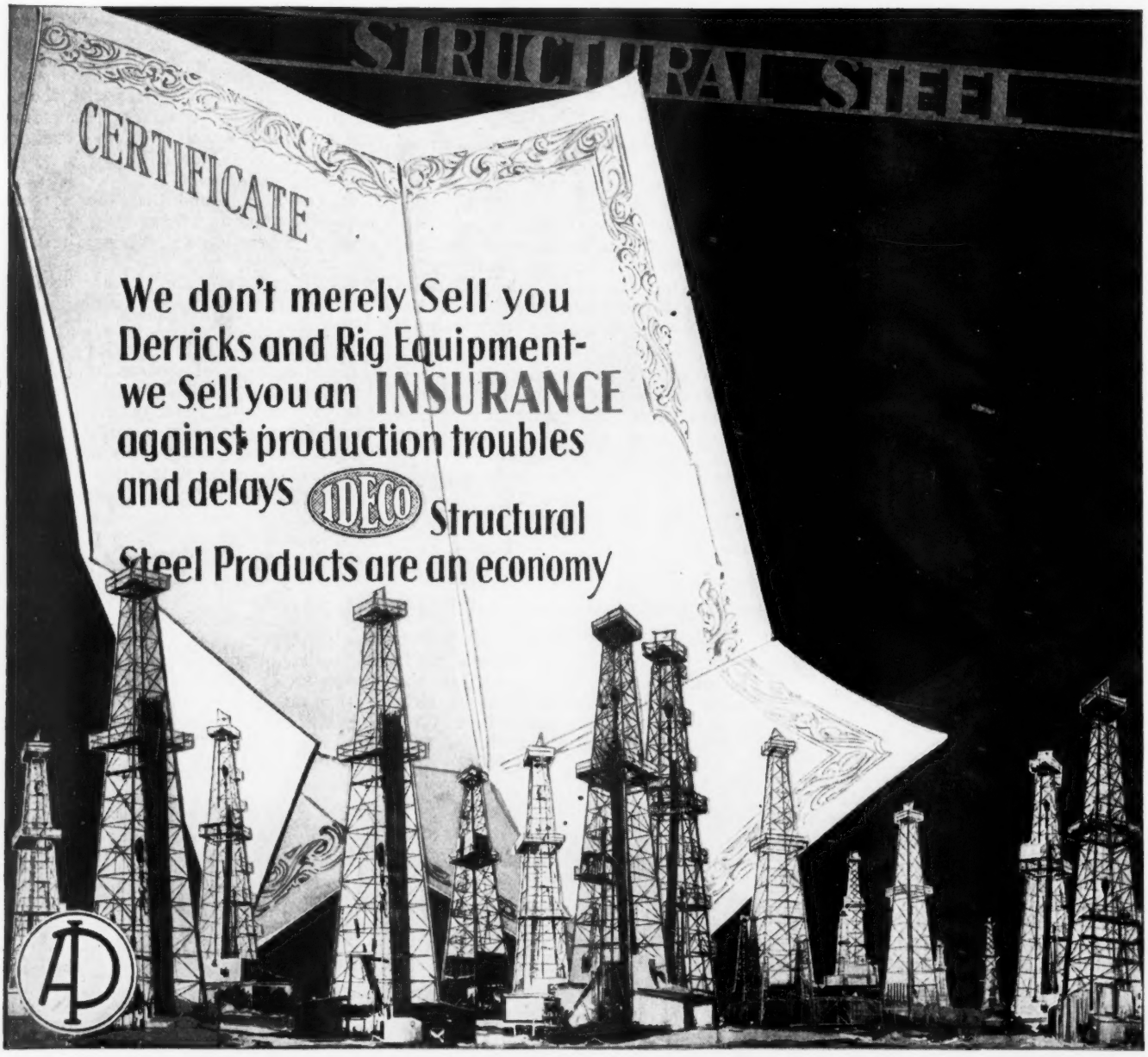
The simplest and most satisfactory means of operating a well on gas lift is by the use of one or more compressors connected directly to the well, but where wells have declined to a



National Intermitter in use for intermittent and pulsating flow of wells

*Consulting engineer.

IDECO



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low production it may become more economical to employ a common header system.

Separators

It has become the practice to install separators at the well, usually with sufficient elevation that the oil will gravitate to the stock battery. The size of separators in more general use is 5 feet by 15 feet, although a few separators 7 feet by 22 feet, and 4 feet by 12 feet have been used where the quantity of oil and gas required such a size.

Separators in general use in the Seminole field are the National, Smith and Trumbull makes. If the flowing of small wells gains ground, it may be that traps of 3 feet by 8 feet or even 2 feet by 6 feet may come into use.

All sharp bends and horizontal lengths between the control head and the separator are eliminated where it is feasible to arrange in this manner.

Compressors

Almost every make of compressor found on the market is represented in the Seminole field. For large wells the writer favors the small electric-driven type capable of handling from 200,000 to 300,000 cubic feet per day, since this size insures the greatest degree of flexibility and dependability, which are the prime factors in the operation of new wells with large production.

Later in the life of the well, that is, when making 400 to 500 barrels per day or under, there is greater economy in the use of compressors driven by gas engines, especially when fuel gas from the lease is available at no cost, and this economy in operation more than offsets occasional loss in production resulting from increased shut-down time.

Two types of compressors can be employed for this later stage, one in which the small compressor is driven from 50 to 90-horsepower gas engines, and another type in which the compressors are direct driven by gas engines, and have capacity of 500,000 to 1,000,000 cubic feet per day.

Tubing

Where the oil string is 5 3/16 inches in diameter, a 2-inch upset tubing is usually employed through which to convey the gas to the bottom of the well, the oil being flowed through the annular space. With 6⅝-inch casing, a 2½-inch tubing is usually employed.

After the wells have declined to a considerably lower production than the initial production, it is found advisable to employ tubing through which to produce the oil, in order to reduce operating costs. Flow tubings of 4-inch, 3-inch, and 2½-inch have been employed in the Seminole field.

Much care must be taken in changing to flow tubing, otherwise there may be a serious loss in production. For instance, it is unsafe to run 4-inch tubing for producing a well in which the production through 6⅝-inch casing exceeds 300 barrels per day. This figure of 300 barrels is not stated as a fixed figure, since bottom hole pressure has a great influence on production possibilities through pipe of different diameters.

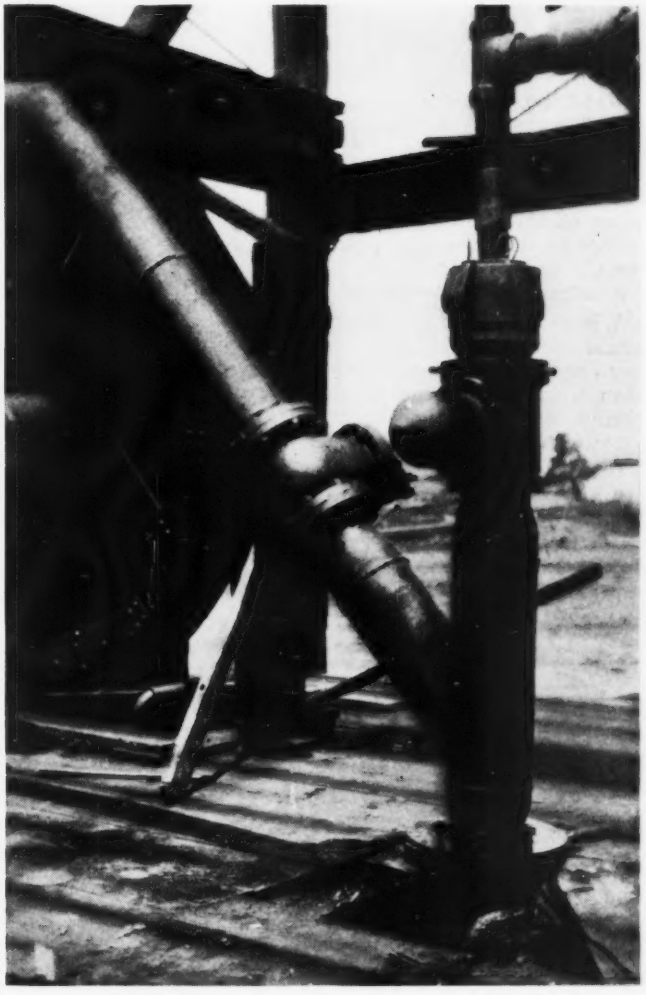
Tapered tubing is being employed in only a few instances at the present time, owing to the trouble arising from the lower and smaller diameter section becoming corroded thereby causing loss of production.

Gasoline Manufacture

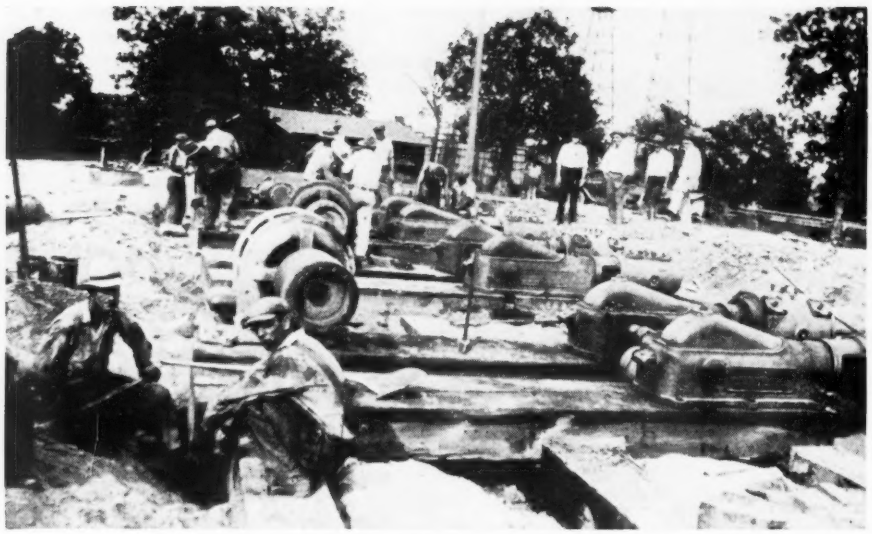
The use of the gas lift in the Seminole field where the oil is of high gravity has resulted in large production of gasoline, now amounting to more than 1,000,000 gallons per day in this field. The capital invested in gasoline plants in Seminole runs into many millions of dollars.

Production of gasoline per thousand cubic feet of gas varies widely, depending on the period in the life of the well and on the degree of gasi-

Hook-up at well when flowing through tubing



Hook-up at well when flowing through the casing



Small motor-driven type of compressors being installed

fication employed in lifting the oil, and runs from 1½ gallons per thousand cubic feet to five or six gallons per thousand cubic feet. The average is probably somewhere between one and one-half to two gallons per thousand cubic feet.

In the use of the gas lift we can use another standard, that of gallons of gasoline per barrel of oil lifted, and in one instance of a production amounting to about 30,000 barrels of oil per day the gasoline produced averages about six gallons per barrel of oil.

Gas-lift operations have resulted in oil of somewhat lower gravity, possibly as much as three or four degrees lower gravity, than oil that is pumped, but the oil lifted by gas lift is much more stable and is more satisfactory to handle through the pipe line systems.

Intermittent Flowing of Wells

When wells have declined to low production, that is, 200 barrels per day or less, various methods have been tried out for the purpose of reducing the operating expense of gas lift work.

One such method is the use of intermittent flowing, in which the gas is admitted to the well at regular intervals. For instance, during a period of six minutes the gas may be admitted for three minutes of this time, and closed off for three minutes. This operation is said in some cases to result in small increase in production, and in the use of less compressor equipment for lifting the oil. No changes of tubing need be made for this type of intermittent, or pulsating flow.

Another method of intermittent flow has been tried on a few wells, in which a tubing of a given diameter, perhaps 4 inch, with one or two lengths of 5 3/16-inch casing attached to the lower end with standing valve set in the lower end of the 5 3/16-inch is lowered into the well, inside of which a tubing of about 2-inch diameter is lowered to a point just above the standing valve. The gas is admitted to the annular space between the 4-inch and the 2-inch. The oil is displaced from the annular space into the 2-inch by the gas, and is then lifted to the surface through the 2-inch. The pressure of the gas closes the standing valve and prevents the oil in the tubing and casing being forced back into the sand.

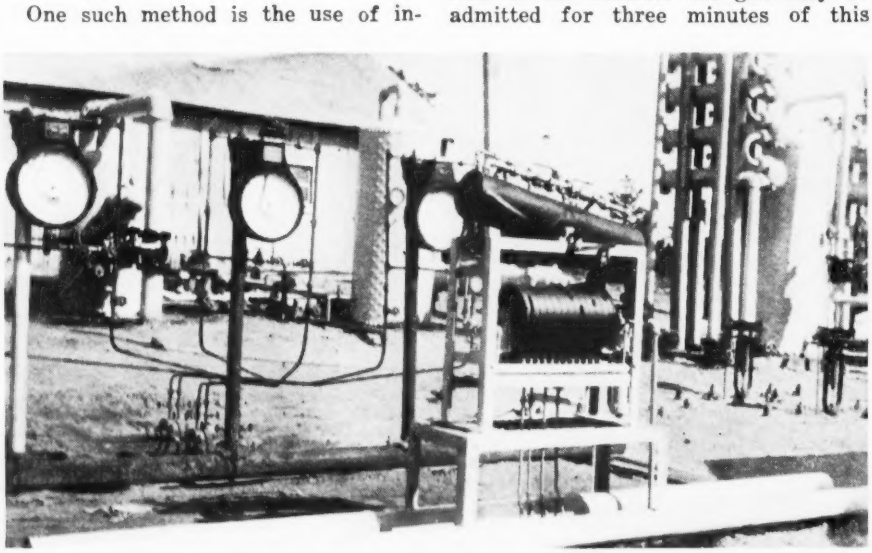
Large direct connected type of compressors being installed

One such well operating in periods of one-half hour, with admission of gas for three or four minutes of this time, is lifting about 40 barrels per day from a depth of about 4000 feet, and has been operating for nearly five months without the loss of a day's production in that time.

This hole was crooked and gave considerable trouble when being pumped, thereby causing much down time. Production when on the pump was from 30 to 40 barrels per day on those days when the pump was in operation.

It might be well to distinguish between the two methods of intermittent flowing noted above, calling the latter by the term "intermittent flowing" and the first method by the term "pulsating flowing."

It would appear possible to lift oil by means of the intermittent method from a depth of 4000 feet with an



Input meters at compressor station

expenditure of 3000 to 6000 cubic feet of gas per barrel of oil. For a depth of 500 feet the quantity of gas would probably be in the neighborhood of 300 to 500 cubic feet per barrel, where the tubing is of the correct design.

Combination Method

A method has been tried out in Seminole in which the gas lift is combined with the pump, the intention being that of making the load on the pump lighter.

In a few cases quite large increases of production have been obtained over that of the pump or straight gas lift. In this method the gas is admitted into the pump column at some point above the traveling valve, in some cases as much as 1000 feet above the valve.

Much trouble has been experienced with wearing of rods and tubing when using this method, owing to the crookedness of the holes in the Seminole field. However, this method has possibilities in fields where there is a coarse, porous sand, where the fluid level is low, and yet where possible production is large.

Where these conditions exist the consumption of gas is high in straight gas lift work owing to the very low submergence, but by the aid of the pump an artificial submergence is provided thereby reducing the consumption of gas for lifting the oil.

Well Testing

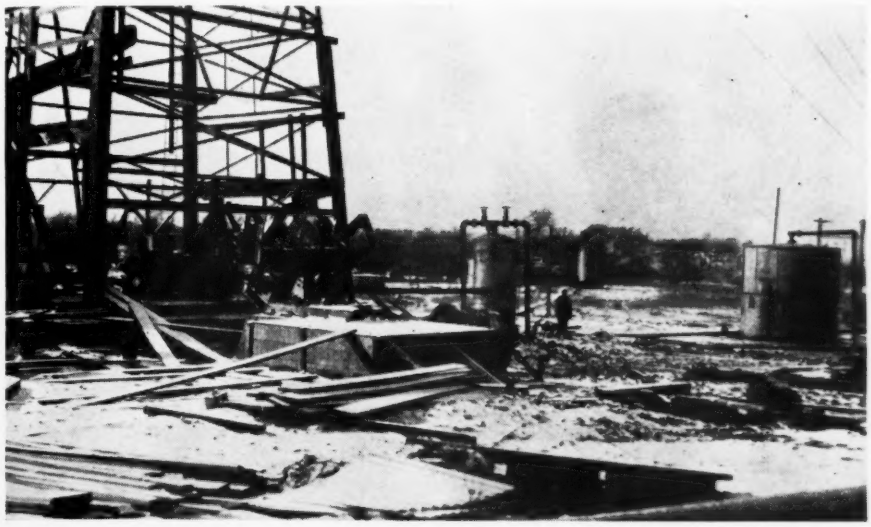
Too much stress cannot be laid on the value of well testing. It has been found that to make a proper test requires the better part of a day, particularly when the time required for making the calculations is taken into account. By means of these tests the proper rate at which to operate the well is determined, and in the case of wells that are six months or more old, this rate will not change materially within about a month; at the end of this period of a month another test should be made.

In new wells, especially in the case of large wells, better results can be obtained by making tests every two weeks. As a whole the best results will be obtained by assigning not more than 15 wells to the testing engineer during the period when the wells are making in excess of 500 barrels per day. The engineer should be held responsible for the performance of these 15 wells at all times.

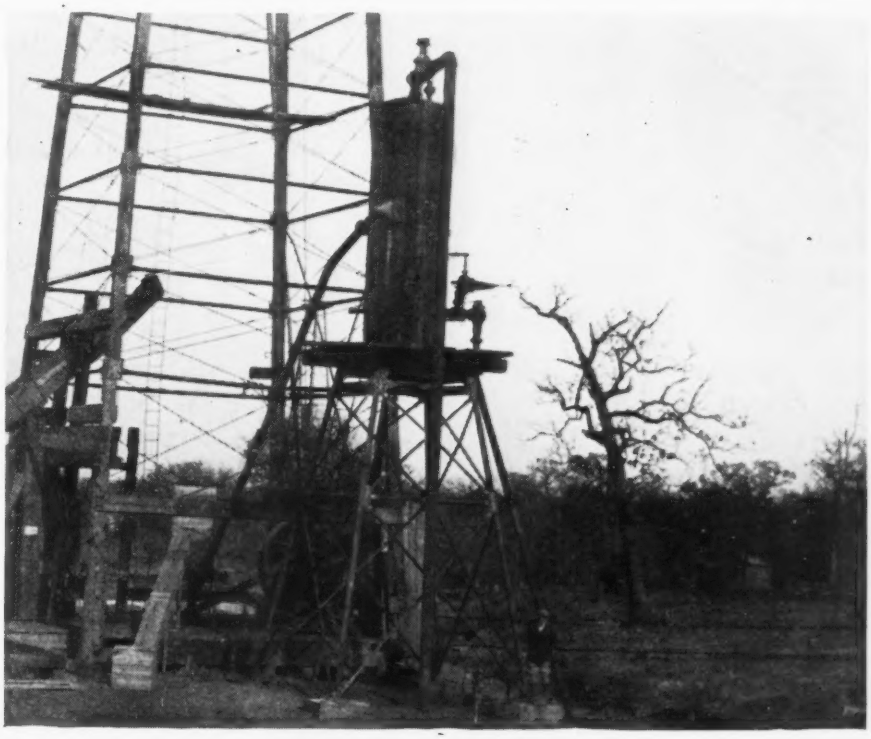
The proper handling of a large number of gas-lift wells requires a carefully trained organization of engineers, which cannot be perfected in a period under six months to a year.

It does not appear likely that we shall have high prices for oil in the near future, consequently the operator must make his profit from the use of improved methods which will result in lower operating costs and in improved recovery of products. Competition is becoming so keen that unless economies and improved methods are

Plant employing direct connected engine compressors with intercoolers and aftercoolers



Well with separator close to derrick, also central separator in the distance



Separator close to the well

adopted the operator faces the possibility of being unable to remain in the business. The engineer has the opportunity at this time of assisting in furnishing and working out these methods, just as has been the case in the mining business during the past 50 years.

It would seem quite possible that some of the methods of gas lift work that have been, and are being, worked out at Seminole and in other fields by the engineers of the various companies will pave the way toward lower production costs and higher recoveries of oil.

Hook-up at well when intermitting through small tubing

Accidents Gain in California

WASHINGTON—Fatal accidents in California oil industry increased in 1928 to 47, according to the Bureau of Mines. During 1927, 41 men had lost their lives in various divisions of the industry.

Of the 1928 deaths, 30 were in the drilling and producing division, one in the pipe line and transportation division, 14 in refining and two in the sales and marketing end. The fatal accidents at drilling wells in 1928 were due largely to an active drilling campaign carried on that year. There were 18 of these accidents last year, compared with but five in 1927. The monthly average number of drilling wells increased from 404 in 1927, to 520 in 1928.

Causes and remedies of these accidents are reviewed in Serial 2596 put out by the Bureau of Mines, Washington.

TULSA—That all oil companies in the Panhandle are not entirely engaged in the business of producing oil, is evidenced by the profit shown by the Magnolia Oil Co. In a wheat venture in Gray county, $1546 was spent in seeding and harvesting a crop on a 200-acre tank farm and the result was a net profit of $2740. Not to be outdone, the Phillips Petroleum Co., is contemplating the erection of a brick plant near Stinnett, where waste gas and clay may be turned into a profit.

WASHINGTON—Better and cheaper methods for removing paraffin from oil wells, and methods of preventing its deposition, constitute the aims of the Bureau of Mines field office at Laramie, Wyo., which is conducting a study of paraffin in oil wells.

A study has been made to determine the action on paraffin of various solvents and the degree of solubility of paraffin in petroleum ether, natural gasoline, kerosene, straw distillate, crude oil and refined mineral oil.

It has been found that relatively large amounts of high melting point wax may be obtained from the paraffin deposits in oil wells.

Geophysical Papers Abstracted

WASHINGTON—Abstracts of many articles prepared by specialists in this and foreign countries on geophysical prospecting for oil, appear in the monthly publication of the U. S. Bureau of Mines, entitled "Geophysical Abstracts." It is compiled by Frederick W. Lee, senior physicist with the bureau. The latest issue is known as Information Circular 6164 and can be obtained from the Bureau of Mines, Washington.

PHILADELPHIA—Following attendance at the International Petroleum Exposition at Tulsa, an extended trip over the Mid-Continent oil area is being made by W. W. Spreng, manager of the petroleum sales department of E. I. du Pont de Nemours & Co., Inc., with headquarters here. Mr. Spreng is accompanied by H. H. James and E. Long, sales representatives.

LIMA. O.—Gramm Motors, Inc., Delphos, O., manufacturer of motor trucks of all descriptions, recently completed a special job for oil field use for Thomas J. Brickerton, Jr., contractor and driller at Monongahela, Pa.

Welded Wrinkle Joints Cut Down Slack in Pipelines

By Paul Wagner
N. P. N. STAFF WRITER

HOUSTON

A NEW type of welded "wrinkle joint" that almost doubles the expansion and contraction available in regular butt weld, or plain end, pipe was employed by the Gulf Pipeline Co. in extending its West Texas trunk system from Midland to the Winkler producing territory earlier this year.

Slack used in the 60 miles of welded 10-inch and 18 miles of combination welded and screwed 8-inch was reduced approximately one-third as compared with that usually thrown into a line of similar size under old conditions.

The new pipe joint is of the integral expansion type with internal sleeve, the purpose of which is to reduce line breaks at times of extreme temperatures, in addition to affording a quick and secure weld.

Expansion and contraction are allowed through the flattening or closing up of the wrinkle feature of the joint. Pipe ends are made larger than the normal size of the joint to permit use of a sleeve, or nipple of the same diameter as the main body of pipe. The sleeve intersects the two joint ends, forming a bridge. In welding the joints the sleeve serves as a base. Uniform diameter of the interior of the line eliminates difficulty from "icicles," or protruding welds.

All the 10-inch pipe used in the Gulf line and a part of the smaller pipe was equipped with this new type of joint marketed by the National Tube Co., which is first made and tested similar to usual material at the mill. Its process of manufacture then calls for heating and upsetting to permit insertion of the die that forms the end wrinkles.

Original wall thickness is retained at the wrinkle in the shaping process. As a result a somewhat higher poundage of steel on overall length is noted as compared with regular pipe.

An accompanying sketch indicates how the new type joint is fitted. Figures reproduced with it show variations in dimensions in the expansion and contraction of each section of the joint under mill tests for tensile strength.

In the case of test figures shown they apply to 10-inch, 34½-pound, seamless line pipe. That part of the joint indicated by the letter "L" in the sketch registered an elongation of .03125-inch when subjected to 500 pounds per square inch pressure an .125-inch at 900 pounds on internal water pressure test.

The joint returned about .01-inch, with elongation of .115-inch remaining, when pressure was relieved slowly from 900 to 750 pounds. The joint returned about .02-inch more on lowering pressure to 500 pounds and .03-inch additional when released to 300 pounds per square inch.

On a re-test, at 1000 pounds pressure, the joint registered an elongation of .171875-inch. Slow release of pressure then resulted in the joint returning 3/64-inch, with a set of one-eighth inch.

In discussing design and construction of oil and gas pipelines before the American Society of Civil Engineers at Dallas, last spring. E. C. Kincade, vice president of the Gulf Pipeline Co., said:

"In the past a majority of oil pipelines have been connected with

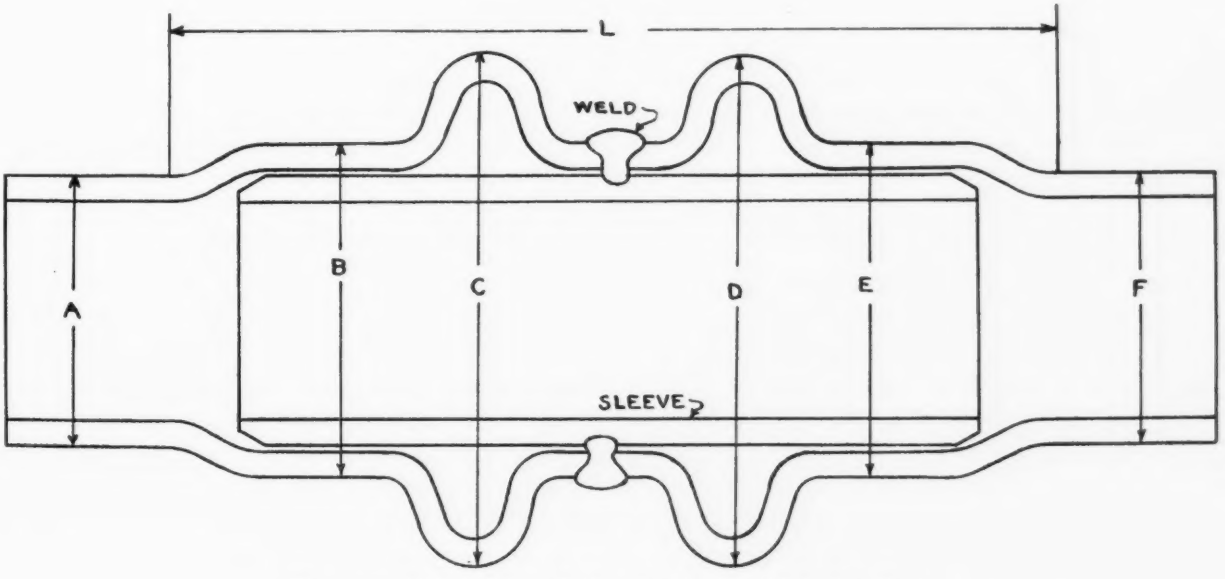


Diagram of the fitting of the new type welded pipe line

Dimensions Of Joint Before And After Test

	A	B	C	Weld	D	E	F
Before	10.75	11.53	13.65	11.71	13.70	11.53	10.76
After	10.68	11.37	11.95	11.61	11.98	11.44	10.75

Just as in travel the successful oil man is satisfied only with the fastest form of transportation and the safest type of plane—so in protecting his wells does he insist on the speediest and safest method of cementing. That method, as every operator knows, is the Halliburton method.

HALLIBURTON OIL WELL CEMENTING CO.
DUNCAN, OKLAHOMA

screwed joints, gas lines with packed couplings. The present trend is to weld lines and I doubt if there will be another screwed oil trunk line or packed coupling gas line constructed of any considerable length.

"The problem of obtaining competent welders has passed, and automatic electric welding for pipelines is being developed which will further simplify welding. Lines are either electric or acetylene welded. Both have about an equal number of sponsors.

"In welding lines provision has been made for expansion and contraction, due to the temperature changes. The temperature range in this section is about 50 degrees, from 30 to 80, which is equivalent to approximately 20 inches per mile. The packed couplings on large gas lines have taken care of this in the past. It has been customary to lay material crooked and crowd into a straight ditch, which in pipeline language is called 'slack.' The amount of slack is guessed at by the man laying the line and generally this is the best he can do. Oftentimes this is not sufficient and the line pulls apart.

"I think a majority of the lines laid in the future, from 10 inches in size up, will have expansion joints."

The Well Shooter the "Ace" Of Oil Field Workers

By Walter H. Jeffery*

THE oil well shooter's occupation is exacting and hazardous. He knows, none better, that his work must be done carefully and efficiently. One blunder might prove fatal, not alone to himself, but to others, and he also understands that he probably will not have the opportunity to commit the same error the second time.

Away from his work, loafing with drillers and tool dressers around the supply stores, the shooter may appear the nonchalant, even devil-may-care spirit. But observe him preparing to shoot a well. The care-free air has evaporated. He moves slowly and with precision. He literally "watches his step" every minute. And he does this, not in a studied manner, but naturally, from long experience.

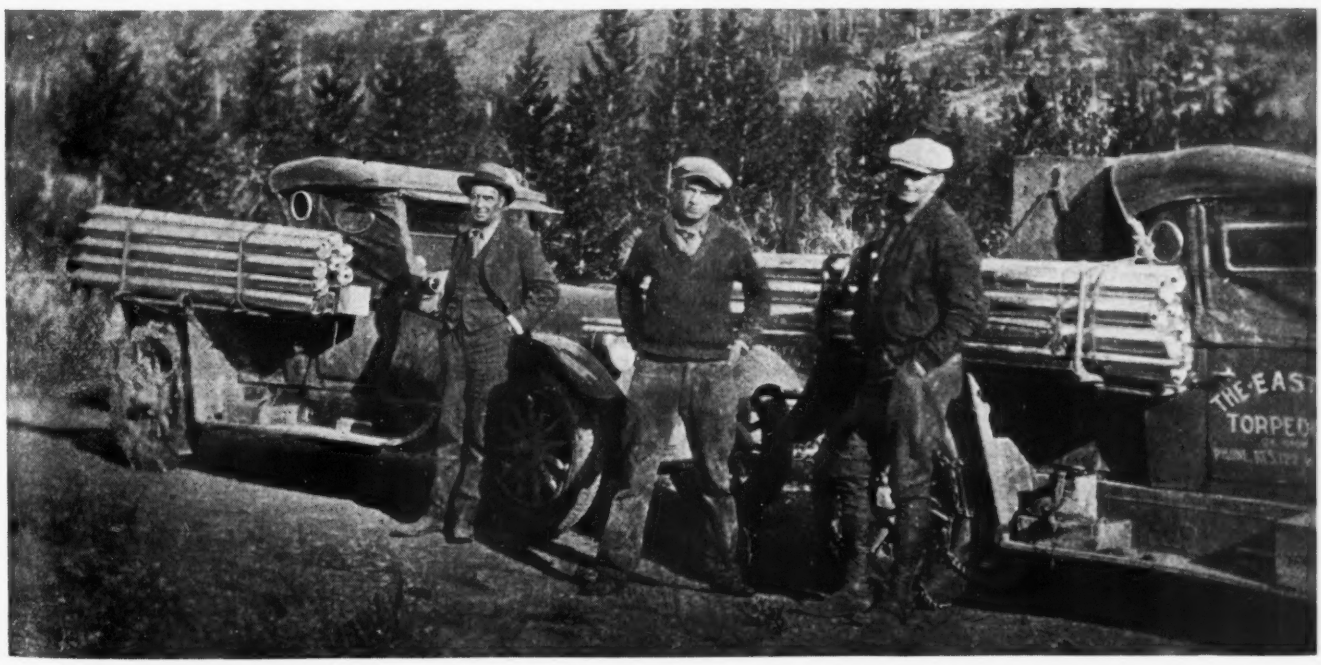
A veteran shooter told the writer that, while putting in a shot, if he felt nervous or if any incident ruffled his temper, even if he had a can of nitro-glycerin in his hand, he would set the can down and go over to the "lazy bench" in the derrick and sit there until he was composed.

The shooter's work is intermittent; he must hold himself subject to call at any hour of the day, or night. He often goes for days with no work, then be called upon to shoot two or even three wells in one day.

He gets up in the small hours of the morning and drives 100 or more miles to an isolated well to arrive at 7 o'clock in the morning, only to find that the well will not be ready until noon. He perhaps good naturedly "bawls out" the drillers, lights a cigarette and sits down to wait, knowing that he cannot get home until late at night. But such occurrences are only part of the day's work and more often than not he turns to and gives the drillers what help he can.

The question sometimes is asked

*W. H. Jeffery Co., Toledo, O., author of "Deep Well Drilling."



Eastern Torpedo Co. of Ohio shooters at a well of the Glacier Oil Co. in British Columbia

Loading the shell with liquid nitro glycerin from a 10-quart can

why would a man choose a life work beset with the danger of sudden elimination? As in other crafts, a son sometimes follows the father, or brother works with brother. Again, many men like the work. Always there are men ready and willing to learn to shoot. And good shooters rarely are out of a job.

A good shooter, one recognized by the producers and production superintendents as a careful man who understands his business, becomes also a salesman. For he literally sells himself. The average producer becomes selective, even finicky, when the time comes to shoot his well and no matter how he may be importuned by several rival shooters for his work, he picks the man he knows he can trust to do it properly.

When a beginner is learning the art of well shooting the first thing he must master is the pouring of the liquid from the ten quart cans into the shells. This sounds simple, but try pouring maple syrup out of a can without spilling any or allowing any of it to run down the nozzle of the can.

A shooter must learn to pour his nitro without spilling a drop or permitting any of it to splatter in the top of the shell, and it is more difficult than it appears. Next he must learn to "run the shell" and to "pull out." And the operation of lowering a shell containing 67 pounds of explosive to the bottom of a 3500 foot hole, requiring about 20 minutes of continuous unreeling of the line is tiresome to say the least. When a man does this 25 times in placing a 500-quart shot he at least knows he has done a day's work.

The deepest well of record that ever was shot was one for Roxana Petroleum Corp. in Oklahoma, and it was successfully shot at a depth of 6165 feet. The shooter lowered his shells to the limit of his 3500-foot line, then spliced the end of that line to the end of another 3500-foot line on a second reel, and continued lowering the shells until bottom was reached.

The one unpardonable error of a shooter is to "pull a shell into the pulley." This means that he has failed to unhook the shell and has either not properly flagged his line or has failed to observe the flag and hoisted the shell up until it strikes the pulley. When a shell is pulled out in this manner it unhooks and drops down the hole and usually explodes when it strikes the fluid level. If that should be in the casing the result probably would be the shooting off of the casing at that point.

Also a shell thus pulled into the pulley has been known to explode there with disastrous results. The shooter usually reels in his line with the drilling engine until his first flag appears, then the engine is shut down and the remainder of the line is reeled in by hand.

Two types of explosive are used in shooting oil and gas wells, liquid nitro glycerin and explosive gelatin, termed "dope" by the shooter. The gelatin is the safer explosive to transport and to handle, but the average shooter prefers to shoot the liquid nitro.

There has been much controversy among producers and production officials regarding the relative merits of the two explosives. Some text books on explosives rate the explosive strength of gelatin at 106.17 as compared with 100 nitro glycerin. This has led to some misunderstanding. The liquid nitro shooter will not concede that any explosive can be more powerful or possess greater shattering force than liquid nitro glycerin. But, granting for the sake of argument that the text books may be right, there remains a factor that is often overlooked.

In shooting wells the explosive is placed in tin containers, called "shells," with a certain capacity in quarts of liquid. Ten quarts of liquid nitro glycerin weigh 32½ pounds as compared with a weight of 28½ pounds for the same quantity of gelatin. It must be obvious therefore, that, quart for quart, the liquid nitro is the more powerful.

It has become recognized that the liquid nitro is best adapted to shooting hard limestones and sandstones, while for shooting softer formations, the gelatin often gives satisfactory

results. Some producers prefer the gelatin for the reason that they have less cleaning out of the well after the shot. This appears to be negative reasoning, however, when it is remembered that the real object of a shot is to shatter down as much rock as possible for the purpose of opening up the oil producing formation to admit more oil into the well.

One of the oldest torpedo men in the business, himself a shooter, told the writer that when gelatin first was introduced for shooting wells he felt some apprehension for the future of his business for it looked as if the gelatin, owing to the greater safety in handling it, and its apparent efficacy for well shooting purposes, might eventually displace the liquid nitro glycerin, which he manufactured and used, so he made it his business to be present when a well was to be shot with the new gelatin, and to pick up and examine fragments of the rock expelled by the shot.

He found what he was seeking—pieces of rock that apparently had been burned by the exploding gelatin.

This reassured him for he knew that the explosion of liquid nitro is so instantaneous and so complete that its effect is to shatter the rock without burning it. The gelatin, being a more slowly exploding agent, apparently had the effect of burning or searing the face of the producing formation, the result of which might be the partial closing of the interstices in the oil sand. It also is well known that occasionally the entire quantity of gelatin is not exploded in the well, but part of it is expelled unexploded, to splatter down about the derrick.

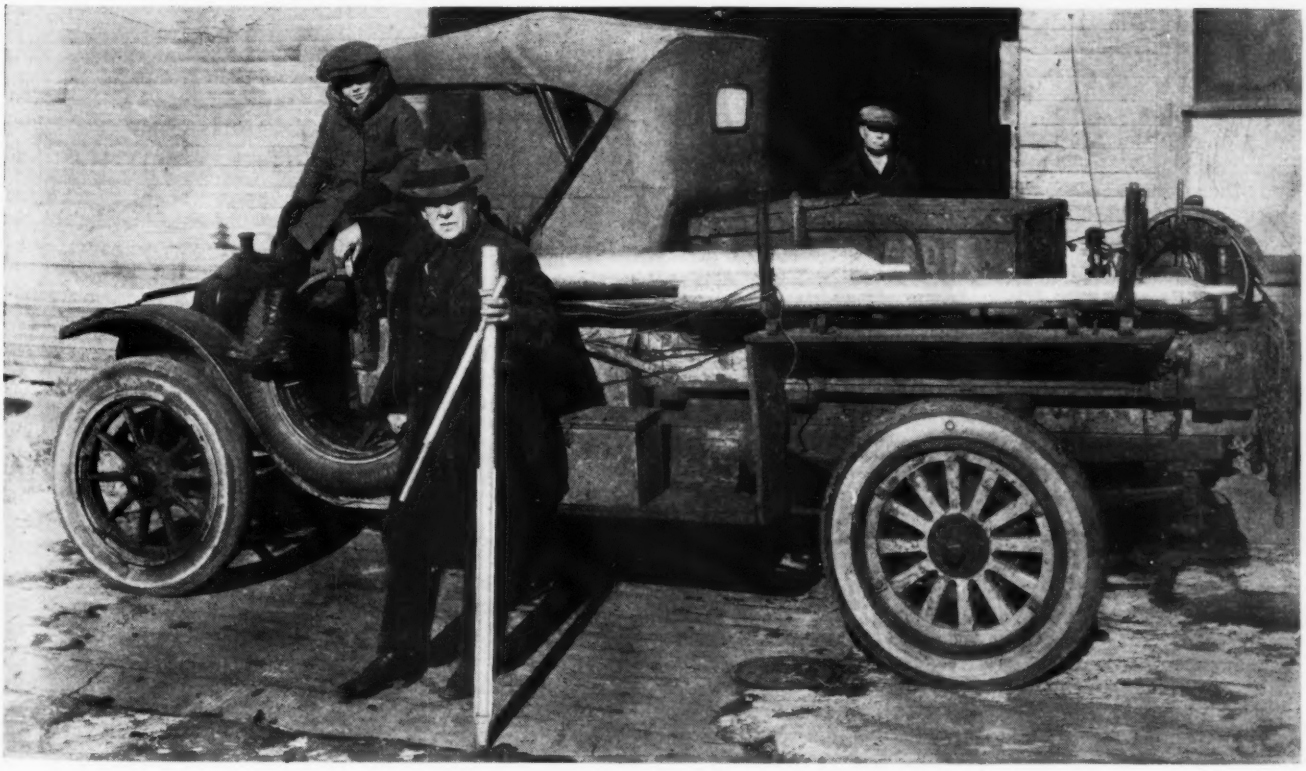
The quantity of explosive that should be used to shoot a well is conditioned upon the thickness of the producing formation or the character of the well. It goes without saying that shooting unproductive formations above or below the oil sand is both futile and a waste of explosive. This may usually be left to the judgment of the shooter and, while he is, of course, desirous of selling as much explosive as possible, usually he will honestly suggest the correct amount of explosive to be used or advise against shooting the well at all if he thinks results will not justify the expense.

Shots vary from two or three quarts up to 1000 quarts where thickness of sand permits. Little economic loss would result if 1000 quarts of explosive were not placed exactly opposite the producing formation to be shot. The reverse is true, however, in a well 3500 feet deep where a thin but rich strata only a few feet in thickness is to be shot. In such wells, and there are many of them, the placing of 5 quarts of explosive exactly opposite the few feet of oil sand becomes a precision operation and should only be entrusted to a shooter of known experience and ability. In such work the correct measuring in of the shot is vital to the successful outcome. Getting an accurate "pick up" with a 3500-foot steel tape where there may be lodestone in the wall of the hole is a difficult operation even for the most expert shooters.

Most producers wish to place as much explosive as possible in the well to be shot and they call for the largest size shells it is safe to run in the casing. The nearer the size of the shell approaches the inside diameter of the casing the more dangerous to the well the shooting operation becomes by reason of frictional contact of the shell in the casing or of a blister or thick spot in the casing, or of a splinter in it. And shells have been withdrawn from wells split from end to end by a steel splinter. To secure the maximum of explosion the dump shot sometimes is used. The explosive either is put in with a dump shell constructed to discharge its contents in the bottom of the hole, or it sometimes is poured in with a stream of water from the top.

It is a moot question if the best results are secured by the large shell and the dump shot or if equally good results might not be had by the opposite procedure, using a small diameter shell, thus providing space between explosive and the wall of the well in which the explosion might have room to expand and to gain momentum or striking force against the wall of the well.

In re-shooting of old wells so called "pig shells" are occasionally used. These are short shells, sealed, which fall over into the old shot hole, one on top of the other, thus making it possible to place more explosive in the oil sand than could be done with the regular shells.



A well shooter and his equipment

Sometimes a shot fails to "come out," to the great disappointment of well owner and spectators alike. In such case the well owner has been known to complain that the nitro glycerin was of poor quality. But he is wrong in this, for nitro glycerin is not a product that lends itself to gradation. The nitro produced in one factory is quite equal in quality and explosive power to that produced in another.

What usually happens when the shot does not come out is that the matter dislodged by the explosion has choked at a point, in the well, forming a "bridge," which must then be "knocked down" and drilled out with the tools. In very deep wells the use of too great a quantity of water as "stemming" (usually erroneously called "tamping") might also confine the explosion in the well.

PERHAPS the questions most often asked of the shooter by the well owner are, "How close to the bottom of the casing is it safe to shoot?" and "How close to the bottom of the casing is it practicable to have the level of the water used to load, or stem, the shot?"

Where, as with many wells, the casing is set just on top of the producing formation, the only safe way to shoot is to pull all or at least part of the casing from the well. In such case an electric squib attached to a length of wire extending to the surface or a time bomb is placed on the shot before the casing is pulled. Wells have been shot without damage to the casing as close as 20 feet from the bottom, but this is risky.

The modern method is first to explode a small shot in the lower part of the productive formation, then to observe the effect on the casing. If the casing has not been damaged this is followed by successively larger shots, each placed farther up the hole and therefore nearer the bottom of the casing. Thus, by exploding five or six small shots, the well may be successfully shot without injury to the casing, and the producer is saved the time and expense of pulling the casing and replacing it; also cleaning out of the material that may have caved in when the casing was pulled.

Wells are shot with the water level only 20 feet below the bottom of the casing but it is safer for it to be 30 feet or more. When oil is used as steaming, wells have been successfully shot where the oil has extended up into the casing.

Occasionally a shell "hangs up" in a well, either from lodging in the casing or from other causes, and unhooks from the line. It then is necessary for the shooter to do one of two things; either fish out the shell or "bleed" it and then withdraw it from the hole. A case of this kind recently happened in the Muskegon, Mich., field which might have had disastrous results.

In this instance the hole had caved just before the shooter ran his first shell, and the first intimation of the cave was when the shell landed on it and unhooked. The driller ran a muffled bailer in an effort to force the shell down but only succeeded in crushing the top of it. The shooter then attempted to fish it out with a grab, used for the purpose, but the tool could not catch in the bail of the shell for that had been crumpled by the bailer.

The shooter then 'phoned his home office for instructions and another expert shooter was sent to assist. He ran a "bleeder," a steel spear with a sharp point and with a hook welded on one side. The idea was to puncture the bottom of the shell, allowing the explosive to run out, then to withdraw the spear and attempt to engage the hook in the bail and pull out the empty shell. The bleeder was lowered to the shell, then raised and dropped to force it through and an attempt thus to bleed a shell in the casing would result in shooting off the casing if the bleeder exploded the shell.

After waiting a sufficient time for the shell to drain, the bleeder was withdrawn and when it reached the top of the hole the hook was engaged with the shell all right, but at the bottom instead of in the bail. Also the bleeder had gone down between the shell and the wall of the hole and the shell still was filled with nitro glycerin. As shell and bleeder emerged the shell toppled one way, the bleeder the other, and at this juncture the hook penetrated the bottom of the shell and the shooter had to hold it in his hands while the contents drained down the hole. Friction of the hook puncturing the tin shell might have exploded the nitro and if that had happened the two shooters, the driller, and the tool dresser might have been annihilated.

SHOOTING companies assume dangerous risks when shooting wells in congested districts where the wells are drilled on town lots. This occurred at Saginaw, Mich., and is occurring as this is written at Dupo, Ill., eight miles from East St. Louis.

There most of the town has been drilled over with wells between two houses, between the house and the garage, on the school house lots, along the electric railway right-of-way and on both sides of a main traveled road. The shots are large, from 100 to 200 quarts and, whenever a well is to be shot, the populace flock around to witness the spectacle.

Many of these people either did not understand the nature of the explosive used or if they did, deliberately ignored the danger for the shooters often had to suspend their work to chase the people away. Finally the police were called when a well was to be shot and they kept the venturesome ones at a safe distance. It is not a pleasing thought of what might have happened had a premature explosion occurred at the top of one of the wells with houses 10 feet away on either side. The torpedo people do not like to shoot these town lot wells, but it is their business to serve their customers and they do it to the best of their ability, but into such districts they send only their most experienced and careful men.

The shooting or squibbing of so called "wild" wells or wells that gather a head and flow either at regular or irregular intervals requires a shooter's best judgment and utmost care. Some of the flowing wells in the several Seminole pools were squibbed, that is, shot the second or third time, with five to 40 quarts of nitro glycerin to stimulate their flow. Many of these wells thus squibbed increased in production from 1000 barrels a day to 3000 or 4000 barrels. In time, of course, such wells would again fall off in production to 1000 barrels a day or less.

SOME years ago in the Breckenridge, Texas field a producer approached a well known expert shooter there and asked him to come out to his lease to observe a well. The shooter went and he was informed that the well was a wild one with plenty of gas and flowed regularly every 40 minutes. He also was told that two other shooters had been given an opportunity to shoot the well and each had refused on the grounds that it was too dangerous.

This man agreed to shoot it and left for his nitro and for an assistant. When they returned he asked the producer when the well was due to flow again and he was told in about 20 minutes. When this time had elapsed the well flowed furiously for several minutes and then subsided. The shooters sat still and waited. The producer said:

"Well, what do you think?"

"We'll wait till she pops again."

In about 40 minutes the well again flowed and then the shooters got busy and successfully lowered the first shell. They then waited successively until the well had flowed twice more, meanwhile, between flows, lowering the remaining two shells. After the shot had been successfully exploded the producer, much pleased at the result, said to the shooter,

"Young man, after what I told you about the kind of well this is and that two other men had refused to shoot it, why did you take the chance?"

The shooter replied: "I'm afraid you will get mad if I tell you."

"No, go ahead and say it."

"Well, I made up my mind that if

METRIC Rate-Volume Controller

What it is –

The Metric Rate-Volume Controller is designed to control the rate of flow of liquids, gas, or air through lines by maintaining a constant differential across an orifice installed between a pair of flanges in a line. This controller consists of a mercury float type differential recording gage in combination with an air control block which has been used for temperature, pressure, and humidity control for many years.

What it's used for

A complete installation consists of the rate volume controller which is installed in the same manner as an orifice meter, an orifice plate, connecting gage lines leading from both sides of the orifice to the controller, and an air supply line leading through the case of the instrument to a chamber above the diaphragm of a diaphragm valve installed in the line either on the up-stream or down-stream side of the orifice.

What it does

The diaphragm valve is maintained in the open position by a spring and is closed by air pressure acting upon the top of the diaphragm. The spring may be set up so that a pressure of five pounds per square inch on the top of the diaphragm will be sufficient to start closing the valve, and a pressure of 10 pounds would be required to completely close the valve, so that for any definite pressure between five pounds and ten pounds there is a definite position of the valve. The diaphragm valve is fully balanced so that its action is not influenced by flow conditions.

Further information upon request

FOR GREATER ACCURACY

AMERICAN METER CO
MEASUREMENT ENGINEERS
CUBIC FEET

Metric Metal Works
ERIE *of* PENNSYLVANIA
AMERICAN METER COMPANY
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Sales Service—WESTCOTT & GREIS, Inc., Dallas, Tulsa, Los Angeles

you were—fool enough to order a well like this shot, I was a big enough —fool to shoot it."

The producer was a good sort and laughed; thereafter that shooter did all of his shooting.

It is an accepted fact among shooters that, no matter how wild a well may be, once a shell is landed on the bottom it will stay there. Occasionally, of course, a shell is flowed out of such a well, but that is when the flow catches it while it is being lowered. This happened at a well in Montana last year. The shell exploded killing the shooter and injuring the driller; also partly destroying the drilling rig.

Some shooters like to tell the story of the time they caught the shell coming out of the hole. The writer knows of but one authenticated instance of this. It happened in the village of Cygnet, Ohio, 35 years or more ago. The well was in the town and a crowd of people was gathered about.

The shooter, McCoy, felt his line slack, knew what was happening, raced to the mouth of the well, knelt down, and, as the shell emerged he caught and clasped it to his body with his right arm and pressed down on it with his left hand, meanwhile he was drenched with the flow of oil. But he held the shell, saved his own life and the lives of the bystanders—but he carried his arm in a sling for two weeks. It was the irony of fate that this same McCoy was killed by a fellow hunter's shotgun while hunting quail a short time thereafter.

It is common knowledge, of course, that occasionally a shooter is killed by an explosion. Other shooters have hair raising experiences, such as the breaking of a steering knuckle, throwing a car carrying nitro into a ditch or even upsetting it. Contrarywise, the writer recently asked a veteran shooter who has spent 30 years at it to relate his most perilous experience. His surprising reply was, "I never in all the 30 years had a single one."

Which makes it apparent that a shooter's career may not be as dangerous as it is painted.

It often is necessary to transport nitro glycerin long distances from place of manufacture to the point where it is used. Owing to the congested condition of many of our roads, shooters and stock haulers often move their stock on these long trips at night or very early in the morning. Always the person driving a truck loaded with stock must be on the alert for careless or reckless drivers on the road. Just a few weeks ago an incident that might have resulted disastrously occurred on an Illinois main travelled highway.

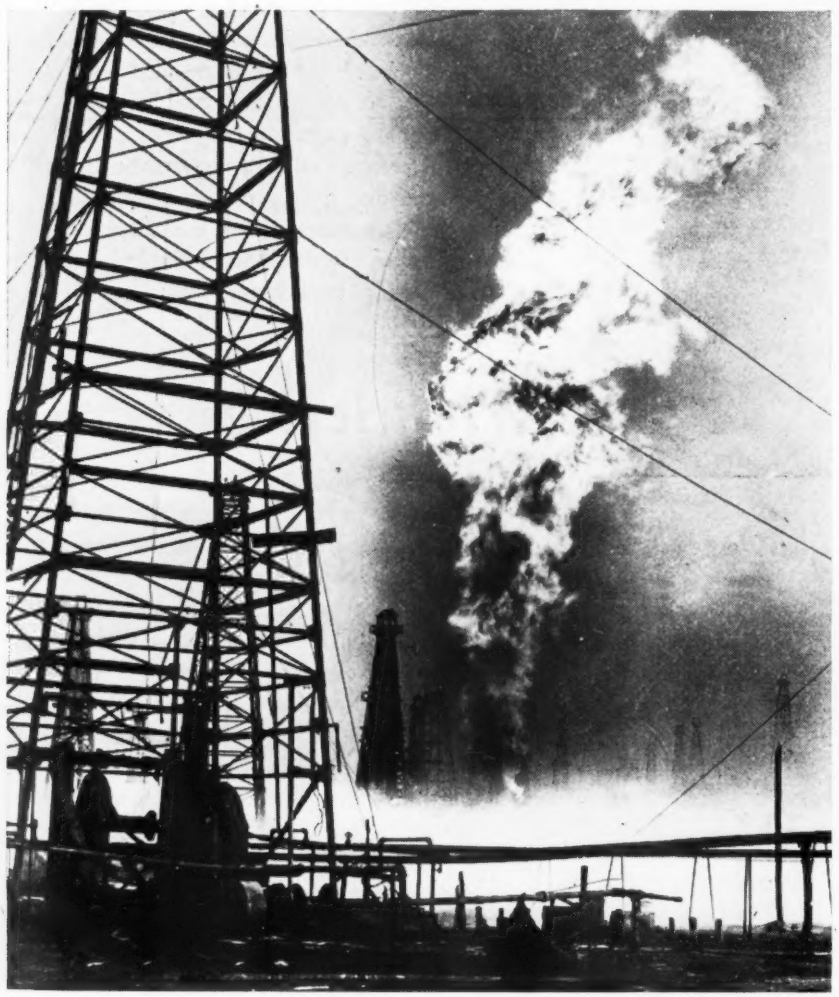
A shooter hauling 40 quarts of liquid nitro saw a car approaching from the opposite direction at high speed and passing other cars. The shooter pulled over as far as he could to the side of the road and stopped his car. On came the reckless driver and his car caught the hub cap of the shooting car and tore it off; also it ripped off both fenders and the running board from his own car. When the fool driver had stopped and come back to learn the character of the load he had struck his hair literally stood on end. If the shooter had not taken the precaution to stop the other car probably would have hit him head on. Why autoists will take such desperate chances is beyond comprehension.

The airplane occasionally is called into play in the transporting of explosive. Earlier in the year when roads from Shelby, Mont., to the Turner Valley field in Alberta, a distance of over 200 miles, were blocked with snow, a well known Canadian aviator flew from Shelby to Calgary with 100 quarts, carrying at the same time the shooter who was to shoot the well. The plane ran out of gas just as the destination was reached and the aviator had to volplane down with his dangerous load, but he accomplished the feat without mishap.

During the summer of 1927 a torpedo company contracted to shoot several wells in Mexico. There was much discussion about means of transporting the 800 quarts of explosive to its destination. Carrying it overland was impossible owing to lack of roads in Mexico.

The oil company planned to have one of its tankers carry the explosive but none of their captains would have anything to do with it. Next a cargo vessel was sought, but without success.

Finally an aviator with a plane about five years old was engaged to do the job. The torpedo people delivered the nitro on the Mexican side of the Rio Grande and then the trouble began. Mexican officials imposed all manner of restrictions. The hills were infested with insurrectos armed with high powered rifles. Federal troops swarmed all over the car transporting each plane load of nitro from where it was stored to the landing field. All concerned literally held their breath until the plane had made the several flights necessary to transport the nitro to the oil field. But if those insurrectos had ever opened fire on the Federal troops guarding the nitro car! Suffice it to say that "all's well that ends well."



—*Underwood & Underwood*

Fire in the Prahova district of Roumania where millions of gallons of crude oil were destroyed. Loss was estimated at about $8,000,000

Drilling to 10,000 Feet

Operators and Engineers from Pipe Mills and Equipment Manufacturers in California Are Now Studying Methods To Obtain Production From This Level and Deeper

By Jack N. Westsmith
N. P. N. STAFF WRITER

LOS ANGELES

AS OPERATORS in various California fields push the drill deeper into the earth's crust in search of "black gold," they find an increasing need for new equipment and new methods to take the place of the machinery and procedure that was satisfactory when drilling to shallower depths.

Manufacturers and dealers have seen the handwriting on the wall. They know that the demand for light-weight equipment and supplies is passing and that an increasing demand is coming for heavy equipment that can obtain production from the 10,000-foot level, or deeper.

Urged on by demands from the operators, the mills are no longer content to stay within the limits of the specifications drawn by the American Petroleum Institute. They have developed, for example, a grade of seamless pipe with a yield point of not less than 95,000 pounds and are now preparing to make pipe with a yield point of not less than 125,000 pounds.

This improvement is a considerable step forward in preparation for the day when commercial production of oil may be obtained from a depth of 10,000 feet.

Ventura Avenue has the distinction of being the most difficult field in California for completing deep wells, because of its hard, shifting and squeezing formations, which must be penetrated in the face of excessive gas pressures. For this reason, operators in the field have found it necessary to keep fully abreast of all the latest developments in oil field equipment and drilling practices. High pressure sands require careful handling and the attention of experienced operators. On this account in many instances the first progressive steps in improved equipment and procedure have been made in this field.

As operators in the Los Angeles Basin fields and in the Kettleman Hills area penetrated the lower sands they turned to the drilling records of Ventura Avenue for guidance in selecting the correct type of equipment and the proper casing program. They have often drafted men from this field to supervise their operations in the new deep tests.

Special interest, therefore, attaches to the materials and methods adopted in the Ventura Avenue field.

Exterior view of Shell Oil Co.'s Nesa 11 at Long Beach, the deepest drilling well in the world

With the discovery of a deep productive oil sand in the Ventura district in 1925, operators realized that drilling equipment and practice would have to undergo a substantial revision if successful results were to be obtained. They soon found that light-weight equipment and pipe would have to be discarded in favor of heavier and stronger material.

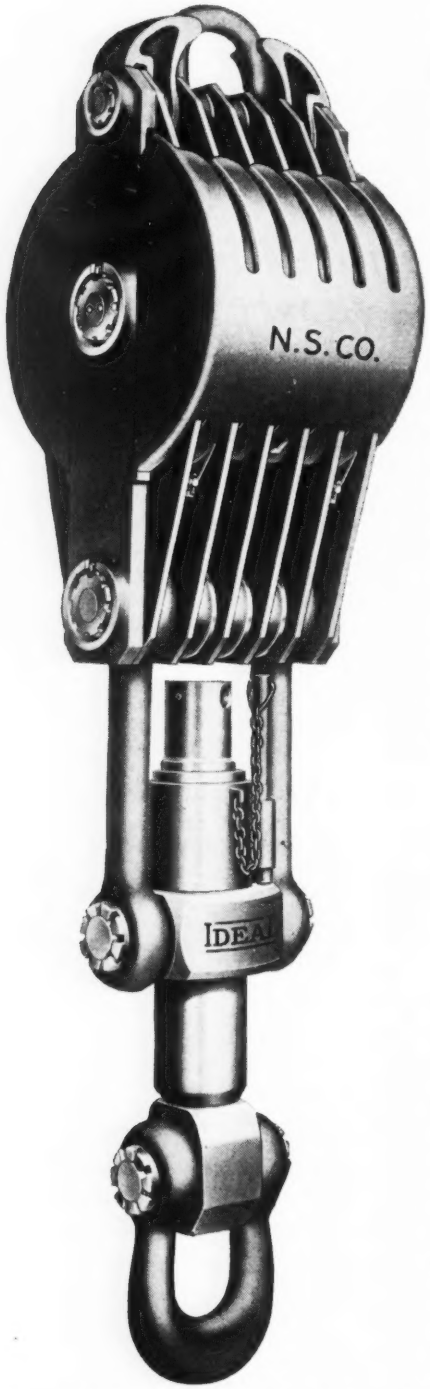
From derricks to bits, practically all parts of the drilling outfit were made heavier and stronger. Instead of using travelling blocks that weighed barely enough to pull the lines down, operators began to use blocks that weighed several tons. High galvanized derricks with concrete foundations replaced wooden structures on insecure platforms. Large twin cylinder, 12 x 12-inch steam engines were ordered so that greater power and more flexibility could be obtained in the handling of long strings of pipe.

This redesigning of equipment was accomplished by representatives of manufacturers and dealers working in cooperation with oil company engineers.

Operators adopted casing programs that would not only meet the water-shut-off requirements of officials of the state oil and gas department, but that would also leave an opening at 6000 feet large enough to permit oil to be produced when found.

Although the casing program at Ventura Avenue has passed through a process of evolution, as productive sands have been found at greater depths, and although changes are still being made to permit greater clearance, the following practice has been adopted as standard by nearly all operators.

A string of 18⅝ or 20-inch stovepipe or screw casing is cemented at from 650 to 750 feet from the surface and below the loose sands, so as to prevent a blowout outside the casing. Next comes a water string of 11¾ or 13⅜-inch A.P.I. seamless casing, which is set at a depth of from 3000 to 4400 feet, the actual depth depending on the position of the hole on the structure.



Type of heavy traveling block used in deep drilling, showing 9-inch extra heavy spring casing clevis for handling very heavy strings of pipe. Designed especially for use in the Kettleman Hills

Depending on what size string is set below the primary surface string, the secondary water shut-off is made with 10¾, 9 or 8⅝-inch A.P.I. seamless. Because of edge-water encroachments in the upper sands, operators generally adopt the practice of setting the secondary string in outpost wells at a greater depth than in wells on top of the structure. This means that water strings set at depths below 6000 feet have over 2000 feet of friction.

Wells are completed with either 6⅝ or 5¾-inch A.P.I. oil strings; the secondary water shut-off is generally reinforced by a combination water shut-off with the oil string. Oil strings with over 3000 feet of perforated pipe have been successfully landed.

Because of the hardness of the oil-bearing formations, a well can often be brought in at Ventura Avenue with an open hole. This practice has several advantages. If the well is wet the source of the water can often be determined and the water can be shut off; and the well may also be deepened without decreasing the diameter of the hole.

If the water strings are stuck before reaching the proper depth, the usual practice is to use 6⅝-inch casing for the secondary water string and to bring the well in through 4¾ or 3-inch A.P.I. oil string or open hole.

The following table showing the depths at which casing has been landed at Ventura Avenue is chiefly of interest because of the unfavorable conditions encountered (greater depths have been reached in other fields):

Deep Drilling at Ventura Avenue

Size in inches A.P.I.	Wt. per Ft. lb.	Depth in feet	Total Wt. in tons	Company	Well
13⅜	61	5400	164.7	Associated	V.L.&W. 12
11¾	54	5256	105.7	Associated	Lloyd 58
10¾	45	4700	141.8	Shell	Taylor 34
9	45	6660	149.8	Associated	Percy 1
8⅝	36	6465	116.4	Shell	Gosnell 30
7	26	7340	95.4	Pan-Kan Oil	Francis 1
6⅝	26	7338	95.4	Shell	Gosnell
5⅜	22.5	8006	90	Pac. Western	Willett 5

Records for speed in making hole at Ventura Avenue are few and far between, because of the caution with which drilling must proceed and because of the numerous fishing jobs made necessary by twist offs in the 4000 feet of hard, sandy shale that is penetrated before reaching the oil sand. For example, Associated Oil Co.'s V. L. and W. 6 was spudded in on May 17, 1929, and was completed on Sept. 5, 1929, at a depth of 7600 feet, which is at the rate of 67 feet per day. In this well, 20-inch casing was set at 700 feet, 13⅜-inch at 4400; 9-inch, 45-pound, at 5800 feet; and an oil string at 7585 feet. Of the oil string, 5771 feet was 6⅝-inch and 1814 feet was slotted 5¾-inch. The tubing was run to 5755 feet.

Use of 7⅝-inch drill pipe is gaining in favor with operators in this field, because the customary practice is now to drill 19-inch holes, instead of 17-inch, below the surface string. Drillers found that the use of 6⅝-inch drill pipe resulted in numerous twist-offs and they adopted the larger size in an effort to minimize this difficulty.

Santa Fe Springs

Drilling conditions at Santa Fe Springs present different problems, because of the large number of sands penetrated and the great depths at which these sands are found.

Profiting, wherever possible, by the experience of operators in the Ventura Avenue field and with the cooperation of officials of the California state mining bureau, some of the difficulties encountered during the early stages of the search for oil at great depths have now been overcome.

Until recently the practice in this field has been to set a 16 or 20-inch conductor string at from 850 to 1200 feet below the surface. This conductor string was set so that the bottom was below the surface sands and gravels, and entering the top of the blue shale, thus assuring a good cement job.

The next cement job occurred at the top of the Meyer zone, at a depth of from 4000 to 4400 feet, the actual depth depending on the position of the well on the structure. Here a 11¾ or 13⅜-inch water string was usually set to afford protection for the Meyer sand. Some major companies set 10-inch as the first water string.

Customary practice has been to set 6⅝, 8⅝, or 9-inch over the Nordstrom sand if the intention was to complete the well in this sand or if the well had as an objective the underlying Buckbee zone, because of the limited size of the Nordstrom zone, the same program could be extended on to lower sands.

Because of the number of wells that have been deepened from the shallow sand to the O'Connell or Clarke sands, it has been necessary to set 4¾ or 5-inch water string over the O'Connell zone. This means that if such a program were adopted the well would run out of hole and therefore could not be deepened to the underlying Clarke zone.

To overcome some of the difficulties found in producing from deep sands in this field, the California state mining bureau has withdrawn its order calling for a protective water string over the Buckbee sand. This withdrawal enables an operator to follow the program adopted by the Associated Oil Co. in its Butterworth No. 8 on the eastern edge of the Santa Fe Springs field. This program is as follows:

18-inch to 800 feet.
13⅜-inch, 81 pound, to 4500 feet.
9-inch, 45 pound, to 7300 feet.
8⅝-inch, 26 pound, to 8100 feet.
4¾-inch, 21 pound, to 8400 feet.

A deviation from this program is

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presented by Standard Oil Co.'s Santa Gertrudes No. 12 on the northwest flank of the field. Here the following strings were set:

18-inch to 808 feet.

11¾-inch to 4273 feet.

8⅛-inch to 7832 feet.

Depths to which casings have been landed at Santa Fe Springs are given in the following table:

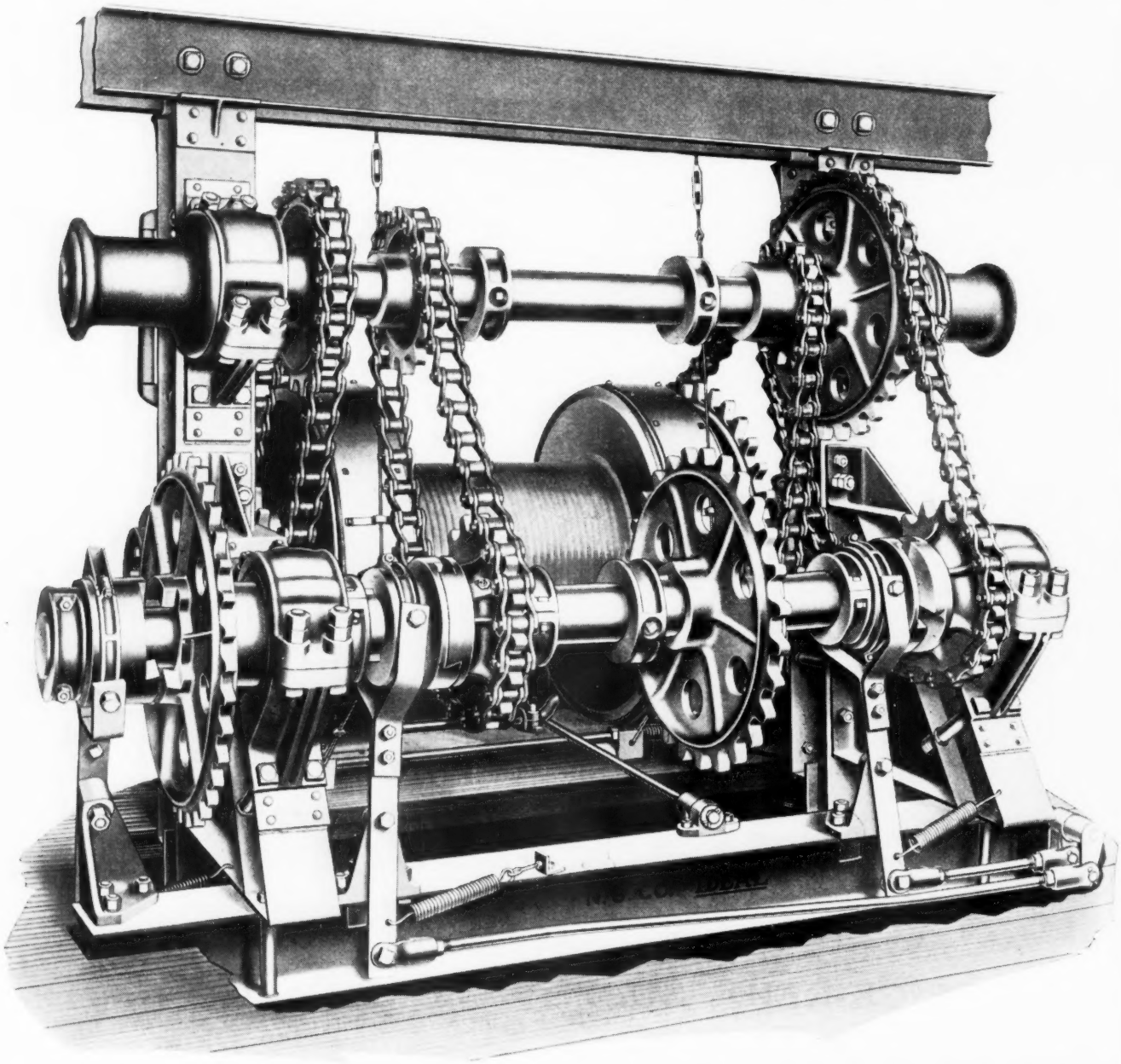
Size in inches A.P.I.	Wt. per Ft. lb.	Depth in feet	Total Wt. in tons	Company	Well
20		900		Associated	Fulton 3
13⅜	61	4252	129	Associated	Fulton 4
11¾	54	4448	120	Associated	Butterworth 8
9	45	7035	158.2	Associated	Fulton 4
8⅝	36	7112	127.8	Shell	Thompson 6
8⅛	40	7832	156.6	Standard	Santa Gertrudes 12
7	30	7980	114.7	The Texas Co.	Patterson 4
6⅝	26	7803	101.4	Standard	Wiesel 13
5¾	22.5	7988	89.9	Shell	Thompson 6
5	15	8050	60.4	Associated	Fulton 4

As at Ventura Avenue, so at this field, few speed records have been made in reaching the lower sands, principally because most of the wells now being completed stopped to produce from the overlying shallow sands before being deepened. However, a number of wells on the outer edge of the field have had as their goal production from 8000 feet, or deeper, and from these wells some drilling time records may be expected.

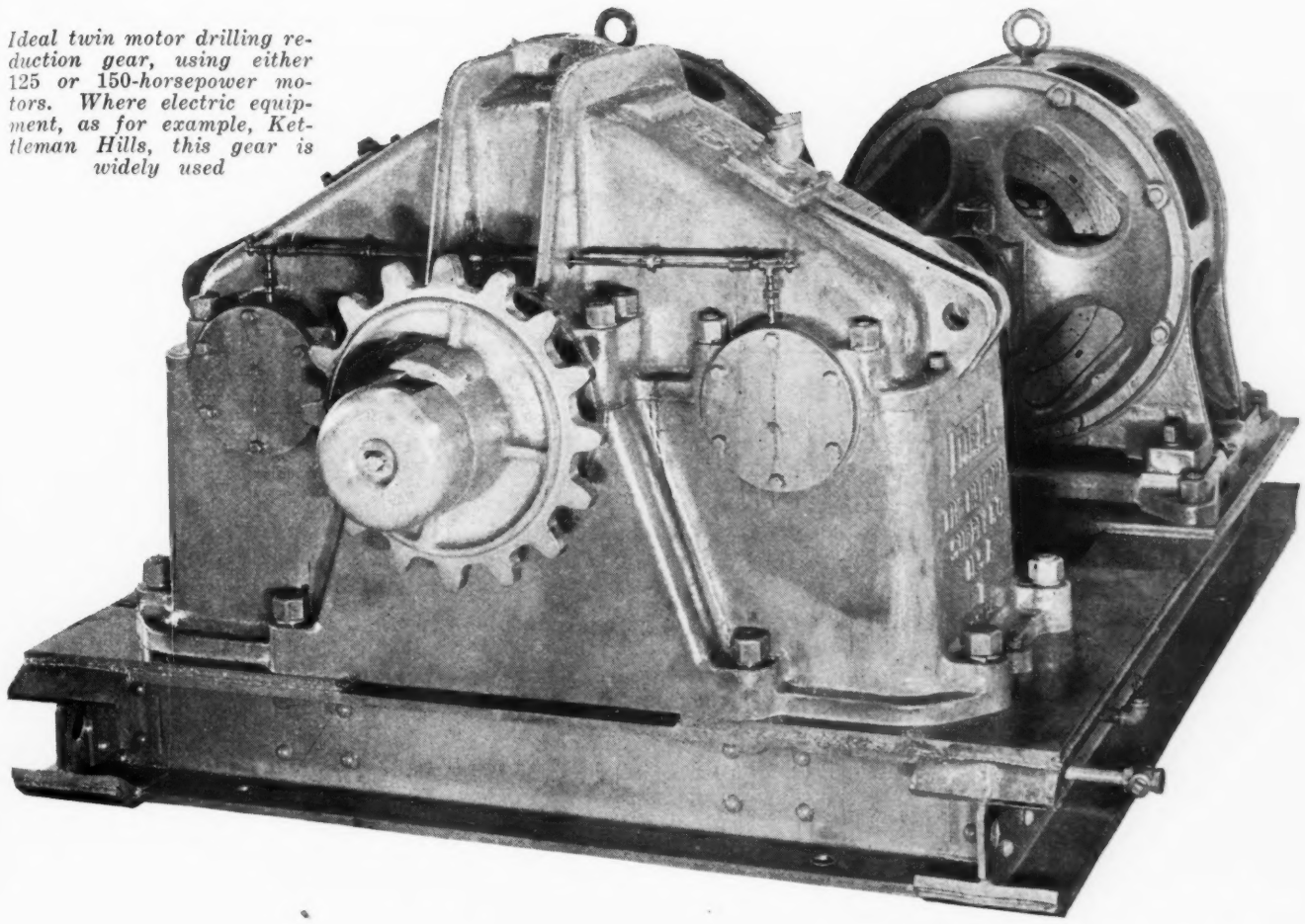
Cost of drilling at Santa Fe Springs usually runs from $175,000 to $200,000. In some instances, where great trouble is found in obtaining a water shut off because of excessive temperature, the cost runs to approximately $250,000.

Cementing long strings of pipe always has given some trouble, but when ordinary conditions are complicated by the presence of temperatures as high as 212 degrees F. real trouble commences. Truck loads of ice were pumped into one well in an effort to cool the bottom of the hole before a water shut off was attempted. A high temperature cement is now reported to be solving most of the difficulties found in cementing these deep wells.

Present practice at Santa Fe



Four speed draw works in use for deep drilling. At Kettleman Hills this outfit is connected with two speeds of a Hild drive to give an eight speed draw works for greater flexibility



Ideal twin motor drilling reduction gear, using either 125 or 150-horsepower motors. Where electric equipment, as for example, Kettleman Hills, this gear is widely used

Springs is to set the 18 or 20-inch casing to below the surface sands, and 13⅜-inch to from 4000 to 4400 feet. From there down the practice differs from the old program. Nine-inch is set on top of the O'Connell, at from 6300 to 6500 feet, 6⅝-inch on top of the Clarke, at from 7300 to 8000 feet, followed by a 3½-inch liner.

Kettleman Hills

Drilling practice at Kettleman Hills resembles that at Ventura Avenue. Here some of the most difficult drilling problems confronting the petroleum engineer are present, and the successful completion of a number of wells has required the most complete cooperation between manufacturers and engineers.

Very hard drilling, coupled with high gas pressure, precluded any possibility of fast drilling. Often not more than from eight to ten feet is made in one day and the average depth drilled per tour is sometimes only four or five feet. In some instances not a single foot has been drilled in a 24-hour tour. This occurs at about 6400 feet on the axis of the structure.

Because of this hard drilling and the depths to which the wells must be drilled, costs per well exceed any so far experienced in other California fields. Milham Exploration Co.'s discovery well is estimated to have cost $325,000. Spudded in March, 1927, this well blew in out of control at a depth of 7108 feet on Oct. 6, 1928, after the drill pipe had frozen at 7222 feet, and the hole rebored from 5800 feet to the present bottom. This well is now making approximately 75 million cubic feet of gas and 3000 barrels of 60.2 gravity oil per day.

Practically all wells drilled in this field will cost in excess of $300,000, because of the hard formation.

Operators at Kettleman Hills have found that electricity has served their power purposes in excellent manner and today nearly 75 per cent of the drilling wells are electrically operated.

Because of the high gas pressures found in this field, drilling mud must be exceptionally heavy and of such a plastic nature that it will wall the hole.

Rotary mud with a weight of 90 pounds per cubic foot is used. To prevent the weighty part of the mud from settling out and thus giving a heavier mud at the bottom and froth at the top, operators are using a chemical compound known as Aqua Jel, a jelly-like substance that tends to keep the heavy ingredients of the mud in suspension. Use of this substance has increased drilling speed through the brown shale below 6500 feet from an average of only eight or ten feet per day to over 50 feet per day.

Determination of what casing program to adopt at Kettleman Hills has been an important problem for petroleum engineers. As little was known of the subsurface conditions, heavier casing than was actually necessary was used in the first wells. Only recently has a scientific study been made of the situation.

A practice adopted by Marland Oil Co. is to set 1500 feet of 18⅝-inch stove pipe casing. The first water string consists of 5100 to 5200 feet of 11¾-inch, 60-pound, A.P.I. seamless, set at the top of the brown shale. The secondary water string is 8⅝-inch, 44.8-pound, high tensile, long collar seamless, set at from 6100 to 6300 feet. This is followed by a perforated oil string 5¾ inches in diameter, 23-pound, run to a depth of about 7300 or 7500 feet.

Another practice contemplates the setting of 13⅜-inch, 61-pound, conductor string; a 9⅝-inch, 47.2-pound, water string; and a 6⅝-inch oil string.

Profiting by the experience of operators at Ventura Avenue, engineers at Kettleman Hills developed this casing program that ends up with as large an oil string as possible and that at the same time starts with the usual 13⅜-inch conductor string, which is generally accepted as the desirable size.

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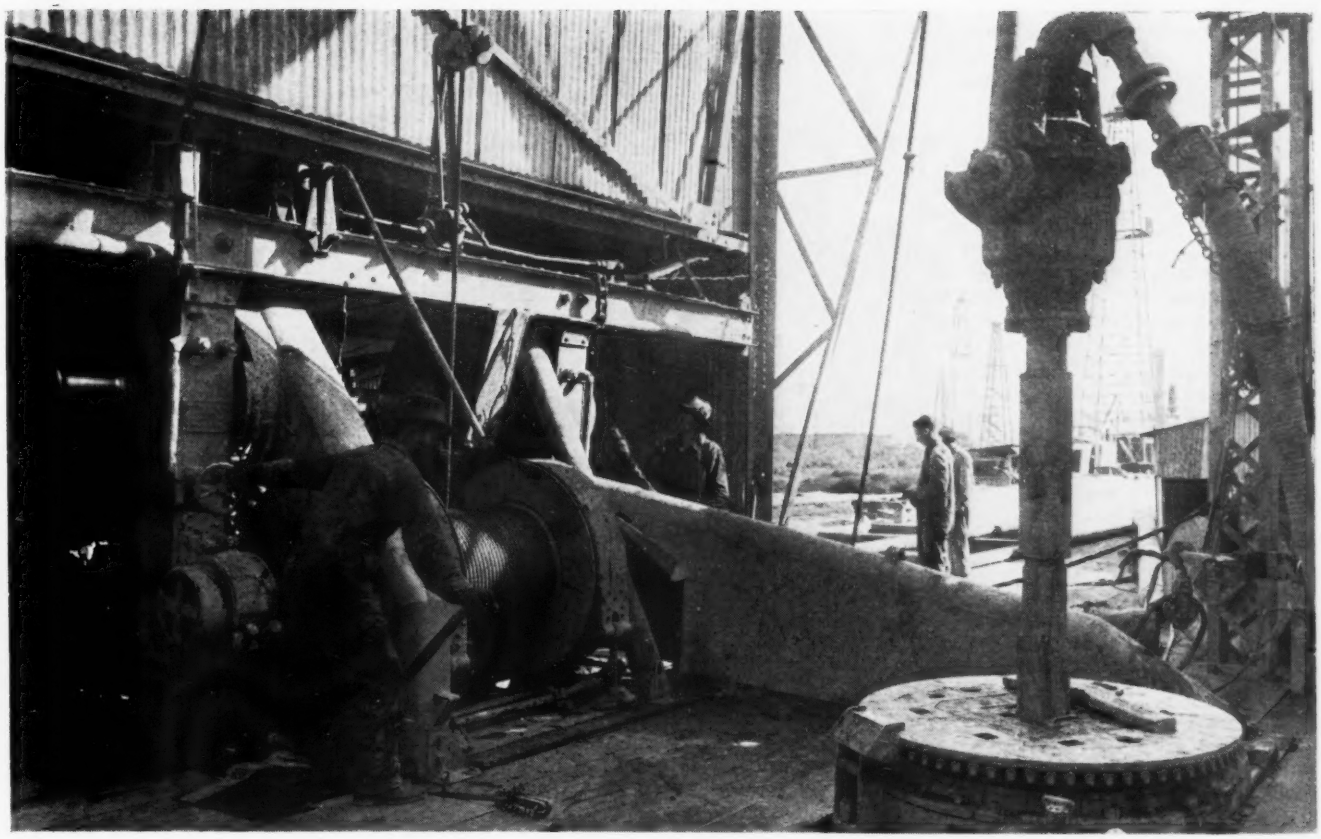


Interior view of rig at Santa Fe Springs, showing Ideal No. 34-26 draw works, 6-inch type "A" swivel and No. 12, 25-inch rotary. Typical of equipment used in deep drilling at this field

Still another program uses four strings: a 13⅜-inch conductor string, a 9⅝-inch water string, a 7-inch first oil string, and a possible future oil string of 4¾-inch casing.

Both the three and the four-string programs have a large following, although a few operators adopt different practices. Operators at Kettleman Hills are able to use fewer strings than are necessary in other California fields, because of the lack of shallow zones that need protection.

To produce oil from this field requires the use of the heaviest equipment made. Ohio Oil Co. used a 38-inch fish tail bit in its well on the South Dome.

Something new in rotary drilling has been developed to facilitate drilling and to afford maximum efficiency in hoisting at deep wells. This innovation is an eight-speed draw works, consisting of a four-speed draw works connected to two speeds of a Hild drive.

Engineers on the Milham Co.'s discovery well used a very different casing program from that now adopted. In the first well 1347 feet of 70-pound, 15½-inch seamless casing was set, followed by 3598 feet of 60-pound, 11-inch. Next 8⅝-inch, 40-pound, seamless was set at 6315 feet. Before tubing could be run, the well blew in out of control.

Since that time, Milham has adopted the three-string program, as is evidenced by the strings of casing proposed to be set in the company's Elliott 2, Kennedy 1, and Beal 1. These wells will be cased as follows:

Well	Casing size in inches	Wt. per foot pounds	Depth Feet	Total Wt. tons
Elliott 2	18⅝	96.5	1470	71
	13⅜	68	4560	155
	9	45	6200	140
	6⅝	28	7200	100
	2½	6.5	7100	23 (tubing)
Kennedy 1	No surface string			
	13⅜	68	4560	155
	9	45	6392	144
	6⅝	28	7600	106
	2½	6.5	7500	24 (tubing)

In the Elliott 2 a total length of casing and tubing of 26,430 feet and weighing 489 tons will have been set when the well is completed and in the Kennedy, 26,052 feet of casing and tubing weighing 429 tons will have been set.

Standard Oil Co. set what is claimed to be the heaviest string of pipe ever run. This record was made when 5154 feet of 13⅜-inch, 83.5-pound, Grade C_1 casing was set in its No. 216-111 P well at Kettleman Hills. Grade C_1 casing has a tensile strength of 95,000 pounds and is equipped with 5½ inches of thread, so that this amount of pipe was buried with every length of pipe run, resulting in a total weight of 215 tons plus for the string. This casing was a special order and is not being reordered.

This record is expected to stand for some time, as the lack of previous experience in the field as a guide caused Standard Oil engineers to take special precautions to avoid the danger of collapsed casing.

Standard Oil Co. also landed other long strings of casing in its No. 81 P, a recent completion at Kettleman Hills, when it ran 5215 feet of 11¾-inch, 60-pound, seamless Grade C casing; and in its well No. 21-33J when it ran 5521 feet of 13⅜-inch, 72-5-pound Grade C_1.

Very little weight is actually carried by the surface equipment in California wells, as the practice is to use a float plug so that only when the strings are lifted off the bottom prior to landing is the full weight felt. To handle the weight represented in modern strings of casing, a number of heavy lines are required. For example, Standard Oil Co. used ten 1-inch lines in landing the 215 tons of pipe in its 216-11P.

Long Beach

Deep drilling in the Long Beach field followed soon after that at

Ventura Avenue and, therefore, its operators profited rather less than did the companies at Santa Fe Springs and Kettleman Hills.

Long Beach does not present many of the drilling problems found in other California fields that have deep sands, and so fast drilling is accomplished.

As an example of an average speed in drilling in the Long Beach field the following record may be cited. This well was spudded in Nov. 16, 1928, and completed at a depth of 6728 feet on April 16, 1929—that is in 151 days. Actual drilling time was 97 days, or an average of 69.36 feet per day. The other 54 days were occupied in such work as reaming, conditioning, running casing, and cementing. Thus the average footage was brought down to 44.56 feet per day.

Drilling from the surface, four days were required to drill 941 feet of 27-inch hole, where 18-inch casing was set. At 2654 feet, 11¾-inch, 60-pound, casing was set, and the drilling time for the 1713 feet of 17-inch hole was 10 days. The 11¾-inch was followed by 5180 feet of 8⅝-inch, 36-pound, casing placed in a 10⅝-inch hole drilled from 2654 feet to 5182 feet in 53 days. Thirty days were taken in drilling a 7⅞-inch hole to 6728 feet, where 5¾-inch, 22.5-pound casing was landed.

Incidental times were as follows: 22 days cementing, 7 days for reaming and conditioning, 18 days for fishing and sidetracking in 7⅞-inch hole and 7 days for washing hole, landing tubing, swabbing and bringing well in.

Long Beach also is noted for having the deepest drilling well in the world, the Shell Oil Co.'s Nesa 11 now standing cemented at 9145 feet. In this well 18-inch casing was set at 940 feet on the sixth day of drilling, 11¾-inch, 60-pound, casing was set at 2550 feet on the eighteenth day, 8⅝-inch, 36-pound, casing was set on the seventy-seventh day at 5300 feet, and 22.5-pound, 5¾-inch casing was set at 9145 feet on the two hundred and sixty-first day of drilling.

A 7⅞-inch hole was drilled down to 9280 feet below the 8⅝-inch and cores were taken from 7500 to 9280 feet to obtain geological information concerning the subsurface formations. This well will probably be drilled to 10,000 feet in search of a commercially productive zone.

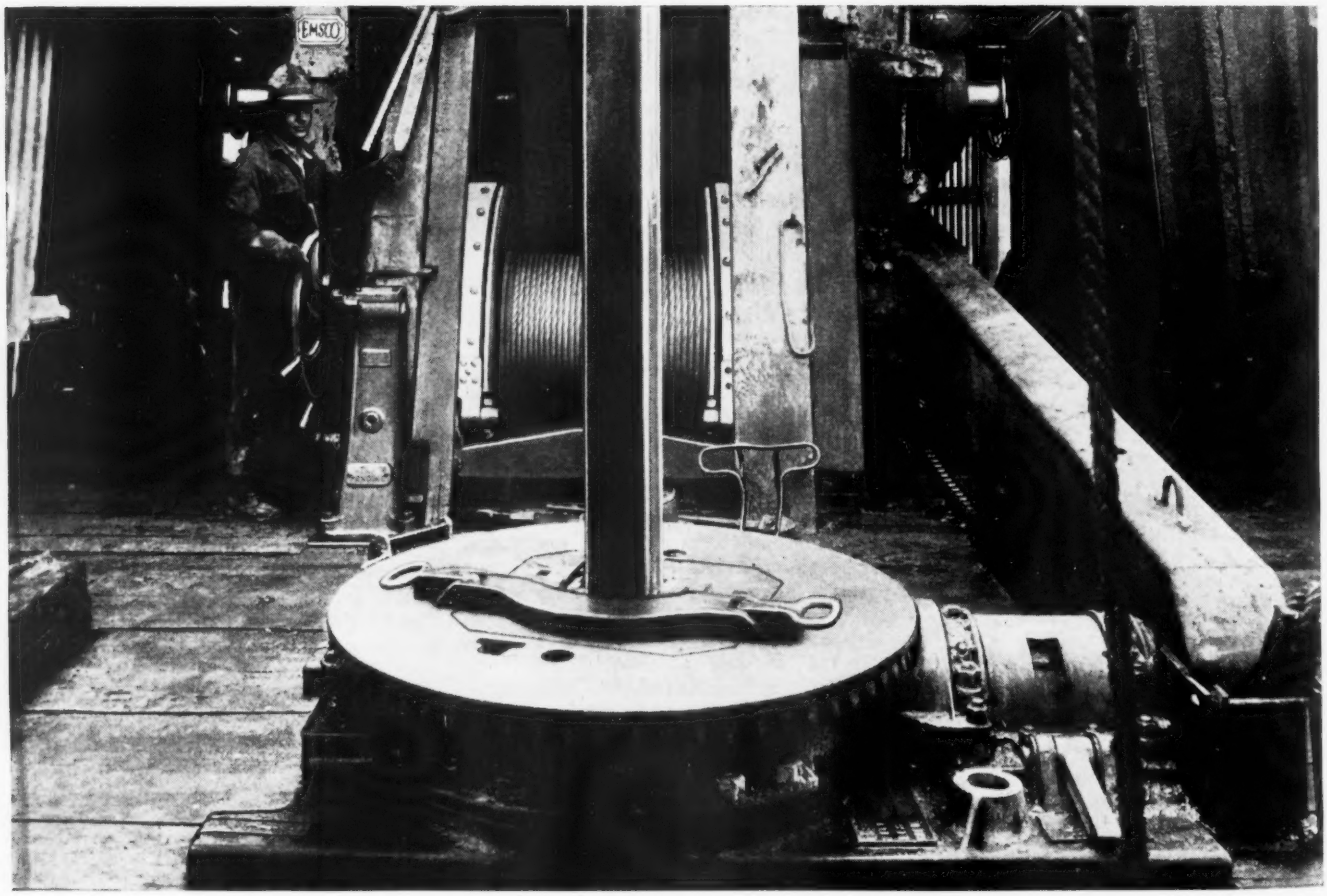
Depths to which casing has been landed in the Long Beach field are given in the following table:

Size in inches A.P.I.	Wt. per Ft. lb.	Depth in feet	Total Wt. in tons	Company	Well
13⅜	61	3293	100	Richfield Oil	Simplex 3
11¾	54	3976	108	Union Oil	Malin 1
9	45	5534	125	Richfield Oil	Butler 1
8⅝	36	5800	105	Union Oil	Malin 1
6⅝	26	7490	97	Union Oil	Long Beach Comm. 21
5¾	22.5	9145	103	Shell Oil	Nesa 11

Outside of the exceptional string of 5¾-inch casing landed in Nesa 11, Long Beach boasts few if any exceptional casing records. Casing practices among the companies operating in this field varies a great deal, with each company meeting its own problems as it sees fit.

Richfield Oil Co. has experimented with several programs, some through necessity and others in an effort to obtain a program suitable to the formations penetrated. In its Haas 11 it varied its program by setting 18-inch casing at 60 feet, 11-inch at 3170 feet, 8⅝-inch at 4127 feet, 6¼-inch at 5280 feet, 4¾-inch at 6367 feet and 2½-inch at 6929 feet.

Shell Oil Co. has adopted a program consisting of setting 18-inch from 950 to 1000 feet, 11¾ from 2800



Interior view of rig, showing workman operating special brake mechanism capable of exerting a pressure of 4500 pounds if necessary

to 3500 feet 8⅝-inch from 5000 to 5500 and 5¾ from 7500 to 7800 feet.

Present day drilling practices in California fields are much nearer perfection than they were in 1923—the previous notable overproduction period of the state—when a 5000-foot hole was considered a lucky break on the part of the driller. Although manufacturers have kept pace with modern demands, the mechanical improvements they have made would not alone account for the exceptional success in pushing the bit toward the 10,000-foot level.

Coupled with the improved machinery has come corresponding development in the training of the drilling crew. Six years ago, with a dearth of experienced men, drillers were accepted and placed in charge of operations without thorough investigation as to their qualifications for the work. They were allowed to complete their education as drillers at the expense of the operating companies.

Today, conditions are different. The old-time drillers have learned to handle drilling equipment more efficiently, technically trained superintendents now are generally in charge of operations, and a closer scrutiny is made of the qualifications of all members of the drilling crew. These changes have greatly reduced the number of fishing jobs, damage to equipment, and loss in footage speed. Many of the former green drillers, having acquired the necessary technique, are today numbered among the most skilled men in California oil fields, but the rough and ready methods of yesterday are not tolerated now. Young men with an engineering school training often use this route on their way to the higher positions in the oil industry, and as a result a much better class of skilled labor is available for the important work of drilling an oil well.

The extent to which the steel mills are working with the operators in an effort to improve equipment material was well illustrated at the recent meeting of the California section of the A.P.I. division of development and production engineering. Representatives of the steel mills frankly discussed the changing needs of operators who are attempting to find production at depths below 8000 feet.

They were unanimous in stating that the mills are ready to meet the demand for steels of a tensile strength higher than that now available, although present steels have greater strength than required by A.P.I. specifications. They all, however, stressed the need for standardization, so that the expense of making pipe to special specifications could be avoided.

Although the manufacturers have developed a steel with a tensile strength of 125,000 pounds, the suggestion was made that for present depths a tensile strength of 95,000 pounds is sufficient.

View showing Ideal automatic grip spider and elevator used in handling long strings of pipe. Spider is ready to take the load when the elevator is released

As a possible time saver in deep drilling, Ben Stroud, of the National Tube Co., called attention to the practicability of running longer pipe. He mentioned an instance in which he had seen a string of over 5000 feet of 11¾-inch pipe run in a little over 13 hours, the casing averaging 39 feet per length. He pointed out that had the string averaged 20 feet per length, double the time would have been required.

Some discussion took place as to the advantages of long threads. Ben Goecke, of the Youngstown Steel Products Co., expressed the opinion that, until the mills had attained greater precision in making tapers, the added length was not of any great practical value.

With the allowed lee-way of ⅛-inch maximum and ⅛-inch minimum, or the improved maximum of $\frac{1}{8}$ and minimum of $\frac{1}{32}$-inch between thread and coupling, Mr. Goecke's contention was that the excess thread fails to support its portion of the weight and therefore, it is useless.

At this same meeting, John R. Suman, of the Humble Oil & Refining Co., Houston, stated that in Texas the usual pipe schedule started with 13⅜-inch, then 9⅝, and then 7-inch, and finished with a 4½-inch, commonly using a 7-inch oil string. With this program, he said that practically no trouble is encountered in obtaining sufficient pipe clearance.

He added also that probably the length of pipe in Texas is usually not so long as in California. In Texas the opertors generally set 9⅝-inch at about 5200 feet. Mr. Suman did not agree with a previous speaker that a tensile strength of 95,000 pounds per square inch would be sufficient, as even at the present time operators at Big Lake when drilling wells 6500 feet deep are using 110,000-pound steel.

ST. LOUIS—A folder has been put out by the Laclede-Christy Clay Products Co. here on its Laclede fire brick which has been in use for 85 years. It comments on interesting facts which happened in 1844 when the company started in business, and tells of advantages of buying its fire brick because of 85 years of effort in making this product.

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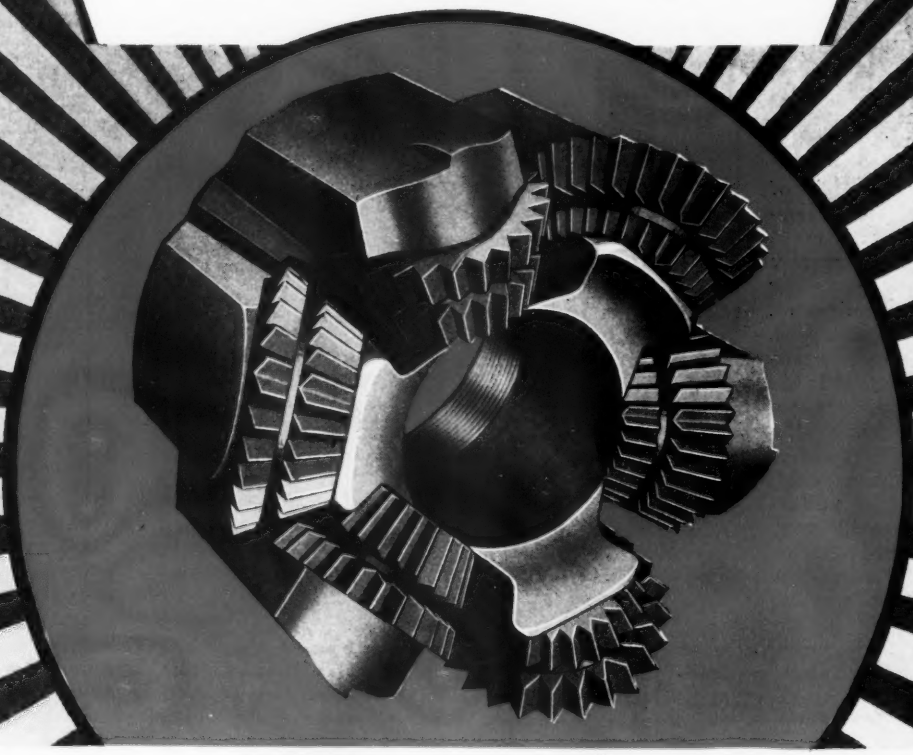

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Cementing Problems Engage Coastal Operators Seeking Solution

By Paul Wagner
N. P. N. STAFF WRITER

HOUSTON

INVESTIGATION of cementing problems in Gulf Coastal Texas and Louisiana has resulted in the following general recommendations calculated to reduce failures and to aid in getting positive water shutoffs:

Low water/cement ratios (below .70 per cent) should be used to help overcome chalkiness.

At least 25 feet of cement should be left in the casing in all jobs down to 3000 feet; and at least 50 feet in all casing jobs at depths between 3000-6000 feet.

Good general practice, easily remembered, would be to leave 10 feet of cement in the casing for every 1000 feet of depth, with a minimum of 25 feet. Special conditions would govern use of additional cement.

Use of chemical accelerators would be limited to plain Portland cement.

It is not suggested that the practices mentioned would solve the cementing problems of the Gulf Coastal territory, but that they would tend to alleviate them.

Next to corrosion, Gulf Coastal operators are agreed there is nothing that costs them more money in development practice than the cementing problem as applied to the handling of casing.

In no other region of domestic oil development has there been the high percentage of cementing failures experienced in Gulf Coastal Texas and Louisiana.

Investigations have disclosed that neat cement, while in process of setting in unsuccessfully handled wells, came in contact with some substance that brought about high loss in ignition and reduction in lime content.

Results have emphasized, according to investigators, either that the present method of cementing is inadequate or that the material being used does not suffice to insure positive shutoffs.

Deteriorating effect of rotary mud contamination undoubtedly constitutes one phase of the Gulf Coastal problem. Reducing the weight of mud down to nine pounds per gallon before setting cement has been suggested as a possible aid to successful results, but such practice would bring other and dangerous problems. The first of the alternative problems is formational. It has been pointed out that if mud is thinned to a weight of nine pounds a gallon it is almost impossible to keep casing from sticking. It can be moved all that may be desired, but if the driller is not careful the casing will freeze before it can be set on bottom.

A second danger is from the pockets of high pressure gas found in Gulf Coastal wells. It is not unusual to find a pocket of gas with a pressure of 1500 to 1600 pounds per square inch, notwithstanding there is no volume to it. The gas blows out and tears up the hole or possibly blows out the drill stem.

Whatever other factors enter into the Gulf Coastal cementing situation remain largely for future determination.

The possible deterioration of cement due to acid condition has been investigated through gas and water analysis, but in no case has an acid condition been reported. It is a well known fact[1] that elementary sulfur and sulfates will retard and, if in sufficient quantity, will entirely prevent the setting of cement, but no water has been found in the Gulf Coast containing enough such materials to bring about the condition mentioned.

IT HAS been suggested that ordinarily one would think these conditions would prevail in West Texas, due to presence of high percentages of calcium sulfate, sulfur and hydrogen sulfide gases, but, on the contrary, a cement failure in that region is rare.

The chemical theory of deterioration has, therefore, been set aside in most cases as indicating possible cause of failure. In line with this theory, several pats of cement containing sulfuric acid (.025 per cent) were made without apparent effect on initial and final setting time in tests of the Humble Oil & Refining Co., in Gulf Coastal territory.

The Humble has been making tests on cementing inefficiency for two years and a half, in which period virtually all its Gulf Coastal cement jobs were cored. The work revealed startling facts, namely, that the following percentages of failures were experienced, all based on appearances of cores taken:

Depths	Per Cent Failures
0-1000	.60
1000-2000	.80
3000-6200	100

Data presented were corroborated by a number of individual cases of cement jobs that were thought to be positive shutoffs, as described before an American Petroleum Institute engineering meeting by W. T. Doherty, petroleum engineer, and M. (Bink) Manning, assistant general superintendent of Gulf Coastal development for the Humble.

The casing of a four-year-old well at Goose Creek was perforated. When fluid was circulated a powdered cement was forced to the top, indicating that the cement had never set.

ANOTHER case was the Humble's No. 2 Urban well at Raccoon Bend, in Austin county, which blew in about a year ago, throwing several pieces of cement from the hole. Three well samples, together with an average sample of cement, allowed study of conditions from the time casing was cemented until about 15 days after plug was drilled.

There, in particular, it was evident that the neat cement while in process of setting came in contact with some substance or condition that brought about high loss in ignition and reduction of lime content, according to Messrs. Doherty and Manning.

Almost the reverse of the Gulf Coastal situation was shown by an investigation conducted in California by the national drilling practice committee of the American Petroleum Institute. It was found that out of 183 cementing jobs 90 per cent had been successful.

One California major operator reported only 1 per cent of the 6⅝, 8⅝, 5¾ and 3-inch casing jobs had failed; and the failures on 11¾-inch jobs amounted only to 5 per cent.

California practice appears to call for drilling holes of sizes such that the area of the cross-section of the casing shall be greater than the annular space between the casing and the hole. Operators there recommended 10 days to two weeks setting time on

[1]Paper by W. T. Doherty and M. Manning, Humble Oil & Refining Co., before American Petroleum Institute Division of Development and Production Engineering, Dallas, April 3-4, 1929.

cement without any accelerator and four days for cement used with accelerator.

Summarizing reports, several causes of water shut-off failures were found: (1)—one probable reason is that the casing was landed in unsuitable formation; (2)—a heavy mud wall, which washes away leaving a channel around the cement, between the wall and the cement; (3)—improper placement of cement due to gauging errors in following cement with second plug; and (4)—agitation of cement by gas.

The experience of W. L. Olmsted, general production superintendent of the Panhandle Refining Co., Wichita Falls, indicates that the presence of an air pocket in the subsurface may create cementing problems.

In the Nocona field, of North Texas, he had found there is a three-foot shale break between the gas sand and the oil pay at the 700-foot level. This condition, he described as requiring a perfect cement job to prevent the gas from breaking into the hole after the mud is swabbed out.

"It is noticeable when cementing a well," he continued, "that after the cement is pumped into the casing above the bottom plug that due to its weight it goes down the hole before the top plug is put in.

"Under those circumstances it would seem reasonable that there might be an air pocket left in the casing between the bottom of the top plug and the top of the cement. After the cement is pumped down the hole, if none of it escapes, this air is undoubtedly compressed; and it would seem likely that a pocket of compressed air would be left around the casing shoe if the plug was pumped clear to bottom.

"In the Nocona field there were many cement failures and many good wells were ruined due to incursion of gas. After it was decided this might be caused from an air pocket around the shoe we decided to leave more cement in the pipe. The percentage of cement failures was greatly diminished."

Pockets of air in the casing were described by C. P. Parsons of the Halliburton Oil Well Cementing Co., Duncan, Okla., as a problem the cementing companies are trying to fight. He said:

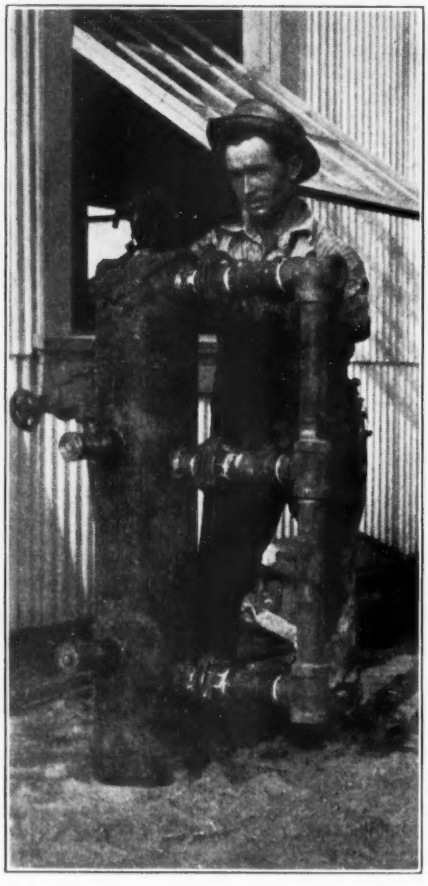
"There was one particular illustration in the Seminole field where the cement stuck in the pipe. None of it got out. The pipe was pulled and the cementing company asked for that section in which the top plug was found. So this top plug in a core set cement was cut out of the string of steel casing. Then it was cut in cross-sections to see what had happened. There was a very intimate contact between the top plug and the core of cement; in fact some of the cement had gone past the bottom washer of the plug and up inside it.

"Of course, that was only one case and it is the first concrete evidence we have had of what actually happened. However, there is another way to combat the air condition by retaining the top plug in a cartridge and making the cementing operation continuous.

"That has many practical drawbacks. In the Oklahoma City field, where they are getting down to very great depths, I saw a well that set 9-inch, 40-pound casing. That represents a lot of money and the owners determined to use every means possible for making cementing operations continuous.

"They used a Butler spider to hold the casing at the plug and they had a cartridge made to put in the top joint but not to withstand the weight of the pipe. This cartridge just held the top plug, and under that plug was a rod in the stuffing box that retained the plug in position. Then the cement was pumped by two outfits through openings below the plug.

"When all the cement was in the plunger was pulled out, the mud pumps were connected and the gate was opened. The mud was pumped over the top and that started the plug in. That worked very nicely, although the practical condition was they were setting pipe off bottom and didn't intend to move it after the operation; so the use of the cartridge is practical in such an instance."



Cement head in use in Raccoon Bend field, Gulf Coastal Texas

Cement Head Avoids Air Pocketing

HOUSTON, Oct. 24.—A cement head in use in the Raccoon Bend field of south Texas, under development by Humble Oil & Refining Co., for the joint account of itself and the Valley Oil Corp., has been found to save from 30 to 45 minutes on every well cementing job, at the same time eliminating air pockets and giving double assurance of proper placement.

The cement head consists of about 50 inches, over-all length, of pipe of the same size as the casing in use. It is built with 2-inch manifolds welded in place and so arranged that the required circulation of mud and the proper placing of cement can be made without breaking-out the connection until it is ready to be removed. The cement head is operated by the closing and opening of valves, the weight of cement carrying the first plug to bottom and the weight of the circulated mud acting to place the second plug.

Two plungers shown at the left of the accompanying picture retain both cement plugs, which are placed in the "head" before it is made up on the pipe. These plugs can be released when desired by pulling out the plungers.

Proper placement of cement is assured in the operation of this type "head," users have found, due to the fact that both the company-operated pumps and the Halliburton cementing pumps are connected for quick switch-over in case of an emergency.

WASHINGTON—The various simplification programs now in effect in various industries are available in mimeographed schedules of these recommendations in the Division of Simplified Practice of the National Bureau of Standards, Department of Commerce, Washington.

These recommendations contain the recommended list of sizes and varieties only as adopted by the industry concerned.

WASHINGTON—An entirely automatically controlled laboratory batch still is being built at the Bureau of Mines San Francisco field office for experimentation. The tower will be virtually adiabatic, which is expected to result in the best possible fractionation. A combination manometer and vacuum regulator has been designed for controlling the vacuum in the fractionation system to within a variation of 2 microns, according to the Department of Commerce.

Outline of Bayou Blue salt dome, Iberville parish, Louisiana, as photographed from the air by the Edgar Tobin Aerial Surveys, Inc., San Antonio. Changes in vegetation show the outlines of the dome as there is virtually no difference of elevation anywhere in the area photographed. A salt dome of this general type is a structural essential to oil production in the Gulf Coastal region of geologically recent sedimentation, where it attains great thicknesses

All-Metal Tanks, Well Grounded, Provide Lightning Protection

By Melbert E. Schwarz*

THE danger from lightning is in the spark, that is the sudden discharge between points of extreme difference in voltage. These sparks can occur either by direct stroke, electrostatic induction or electromagnetic induction.

A direct stroke can take place when a storm center is over some object on the face of the earth which is poorly grounded and thus forms a resistance to the flow of an electrical discharge. A sudden discharge must, therefore, result in a spark.

Sparks can also form between conducting parts, partially insulated, by electrostatic induction from storms overhead or at a considerable distance.

Electromagnetic induction could cause sparks as a result of heavy currents caused by a direct stroke in the vicinity of tank or other structure.

Direct strokes are by far the most dangerous, but voltages by direct stroke are much less likely to occur than by induction. Induced sparks can occur only between isolated conducting parts or by conducting parts in poor contact. These conducting parts can be metal, water, etc. Trouble from electromagnetic induction is probably the least likely to occur.

Steel Storage

The following are the most important factors in the protection of steel storage from lightning:

(1) The most complete protection is an all-metal tank.

(2) Sheet metal roofs should be well bonded with metal to the metal sides in order to insure the best possible grounding.

(3) The side walls of the tanks should be well grounded, that is grounding wires should be carried into the soil to water level if possible.

A tank is normally struck on the edge if the heighth of the wall is greater than one-tenth of the tank's diameter, unless the storm clouds are extremely low.

(4) All projections on the tank deck and all connections to the tank should be well bonded to the metal roof or walls of the tank, as it is of extreme importance that all parts be in the best possible electric contact.

A slightly insulated pipe or other conductor projecting in from the outside, even if it is grounded, could cause a spark. In this connection, grounded gauge chains should be bonded to the tank itself, as otherwise they could readily cause internal sparking.

Power Transmission Lines

The best protection to power transmission lines is afforded by means of a good grounded conductor or ground wire. In direct strokes, the lightning discharge would then tend to take place almost directly over the ground wire without sparking. However, in practice, the chance of a direct stroke is very small.

Experimental tests have shown that it is possible with a favorably installed ground wire to reduce the lightning voltages to one-half or one-third of the value of those induced on an unprotected line. Thus, with this protection available, the higher voltage lines should be practically free from lightning trouble. Electromagnetic induction from lightning is found to be negligible in a transmission line protected by grounded wires.

Grounding

The matter of grounding is of extreme importance as the perfect grounding circuit affords a direct passage for the lightning discharge and if resistance to this is cut to a minimum, the sparking element is correspondingly reduced or eliminated. Driven pipes afford the best grounding electrodes because:

(1) They are easy to install.

(2) Several pipes can be connected in parallel, thus offering less ground resistance.

(3) The connection between the grounding wire and the driven pipe is above ground and can at all times be readily inspected.

Rust on driven pipes is not detrimental to the grounding circuit but all grease or paint should be carefully removed. For depths up to 10 feet, one-inch pipe is most satisfactory and economical, but normally several pipes should be driven and connected in parallel to insure sufficient carrying capacity for the ground wire.

The grounding wire, that is, the contact wire between the object to be grounded and the driven pipe, should be made with the best contacts possible and the wire itself can most readily be soldered into the driven pipe using a lead solder. This wire should be as short as possible with all bends or twists eliminated, as any angular points cause resistance to the discharge.

Driven pipes should be spaced at least 6 feet apart. As the best grounding is afforded through a contact of the driven pipe with moist earth, it is often necessary that the pipes be driven to a considerable depth.

In order to insure better grounding contact in dry earth, it is feasible to dig a small basin at the surface around the top of the driven pipe and fill same with a salt solution. This salt solution seeping through the earth tends to hold moisture and thus affords a better contact medium.

*Rio Bravo Oil Co., Houston

Trunk pipeline runs from West Texas have been recently averaging between 305,000 and 312,000 barrels daily. Tank car shipments have approximated 16,500 barrels, daily average. Runs to West Texas refineries have fluctuated above and below 45,000 barrels daily.

Book Review

"Sedimentary Petrography," a second revised and complete edition, by H. B. Milner, lecturer in petroleum technology, Imperial College of Science and Technology, London, has been issued. The current book embodies much of the original volume published in 1922, and of the supplement of 1926. There are 11 chapters and three appendices.

New chapters are on the microscope, and on quantitative aspects of the subject. The chapter on diagnostic properties of sedimentary rock minerals has been omitted in favor of their logical treatment as alluvial species elsewhere. Twenty-five sporadically occurring minerals in sediment are briefly noted.

The book is illustrated. Of 72 minerals fully described there are figures for 55. Photomicrographs are included of thin sections of 70 typical rocks.

The book may be obtained through NATIONAL PETROLEUM NEWS, 1213 W. Third St., Cleveland, O. Net price is $8. Publishers are Thomas Murby & Co., London, and D. Van Nostrand Co., New York.

THE ONLY BOMB BETTER THAN A ZERO HOUR BOMB IS TWO

ZERO HOUR BOMBS——AND THAT'S THE ZERO HOUR DUPLEX

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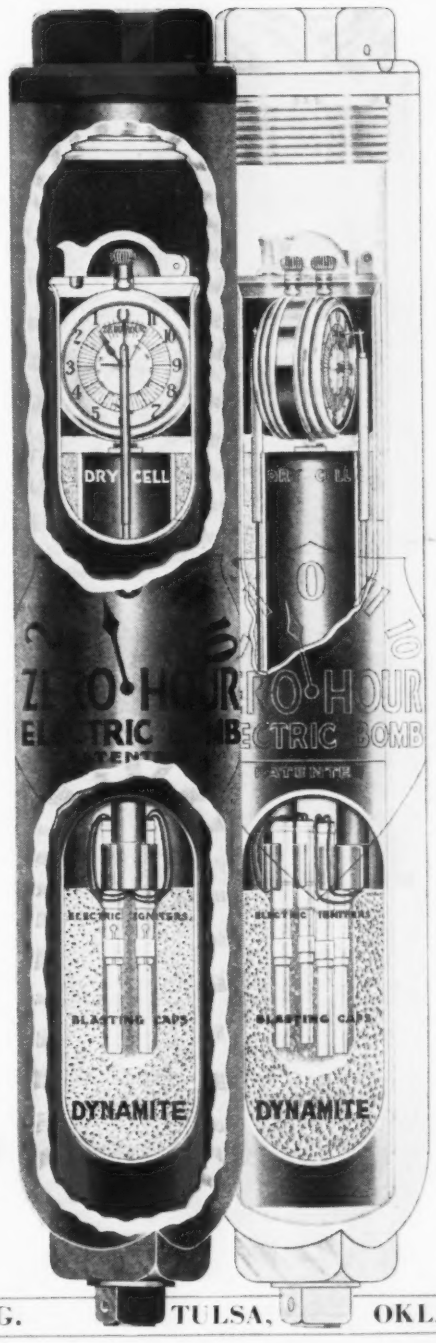
The Zero Hour Electric Bomb, for detonating oil well shots, is notable among the hundreds of business and domestic appliances which employ electricity with scientific skill and precision. At the "zero hour" it is an electric current which sets off the harmless, match-like electric igniters, followed by the blasting caps, then the charge of dynamite which detonates the shot in the well. Always a sure and dependable performer for the Zero Hour Bomb, this electrical principal has been made double sure and dependable in the new Zero Hour Duplex Electric Bomb, which is, in effect, two bombs in one.

The same size container which formerly held the original Zero Hour Bomb, with one watch and one set of blasting caps, now holds the Duplex, with two watches and two sets of blasting caps. Thus, two complete timing and firing mechanisms, each independent of the other, are contained in the same metal, fluid-tight shell which formerly held one only, reducing the chance of a failure with the new Duplex Bomb to a figure so small to be almost beyond computation in ordinary mathematics. The improved firing pin can be moved backward and forward any number of times, in testing, without altering the firing point from "0," at which it is originally set. The new "plug and socket" method of connecting electric igniters makes loading easy and assures perfect electrical conditions. Use nothing but Zero Hour Duplex Electric Bombs to detonate your shots . . . and obtain up-to-date, economical efficiency in oil well shooting.

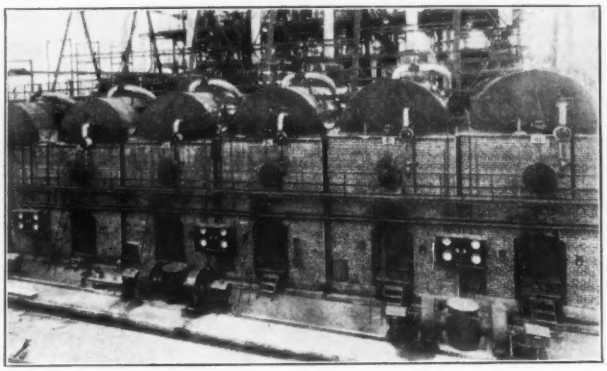
Zero Hour Bombs are obtainable through all principal torpedo companies



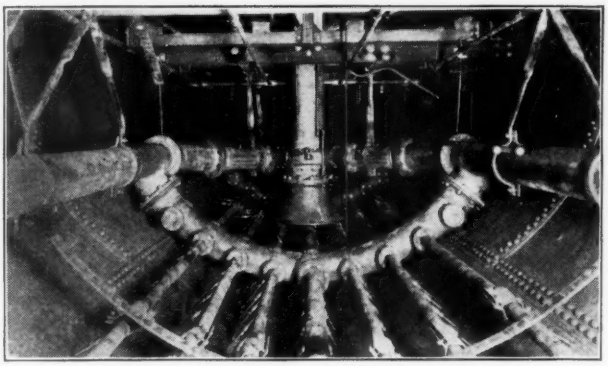
Zero Hour Electric Bomb

ZERO HOUR TORPEDO COMPANY 408 COSDEN BLDG. TULSA, OKLA.

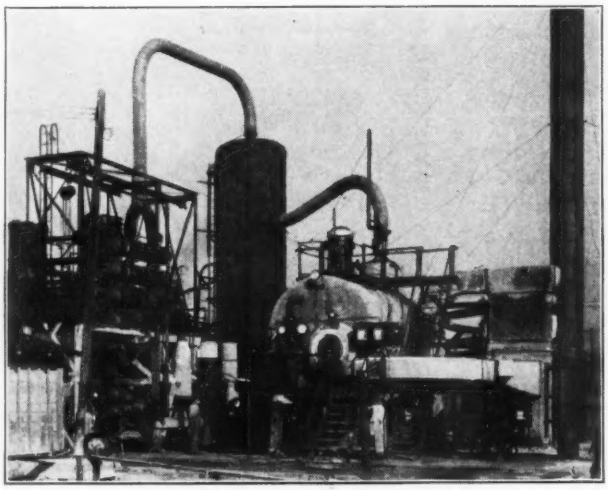
OIL REFINERY EQUIPMENT



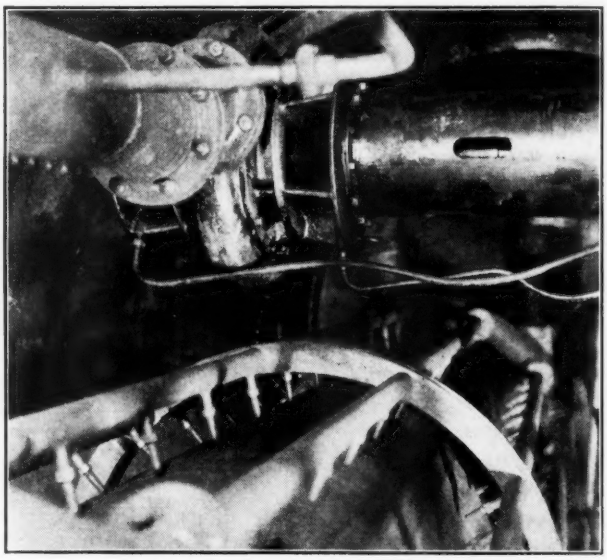
Six 12' x 45' Bottom Fired Oil Circulation Stills equipped with mechanical atomizing burners.



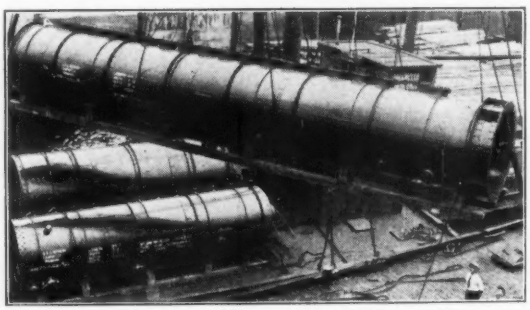
Interior View showing application of Oil Circulation to Bottom Fired Stills. This application increased stilling capacity five to ten times.



Oil Circulation Still, 10' x 24'. Heating capacity of still, 12 million B.t.u. per hour.



Interior View showing application of Oil Circulation to Firing Tube. This gives high heating capacity and unusually high thermal efficiency.



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Petroleum Refining Engineers

KANSAS CITY, MISSOURI

Uses of Aluminum in Oil Fields

By J. O. Chesley*

IN CHOOSING a material to be used in the construction of equipment employed in the oil fields and refineries, a number of factors must be considered. The ideal material would, of course, be inexpensive, easily fabricated and resistant to the corrosive action of such chemicals as are associated with oils and their refined products. But ideals seldom exist; a material may be perfectly satisfactory in one location and not in another. The actual test is, therefore, in the field rather than in the laboratory.

For certain purposes aluminum is finding extensive use in the petroleum industry. This is especially true of the limestone areas of West Texas and the Panhandle, in which petroleum has associated with it hydrogen sulfide gas. This gas, even in moderate concentrations, is corrosive to iron, steel, copper and lead.

As an example of the effect of hydrogen sulfide, the action on certain steel lease tanks may be mentioned. Sulfur readily unites with iron to form iron sulfide compounds. In the case of these tanks, the steel was eaten away by this action, and sulfide scale produced. This scale flaked off, and was later deposited by the oil elsewhere in the tank. Wherever it came to rest as, for example, in the brine at the bottom of the tank, galvanic action set in due to the differences in potential between the sulfide scale and adjoining steel. The result was bad pitting at these points.

Aluminum is not attacked by hydrogen sulfide, sulfur dioxide or sulfurous acid at any temperature. Sulfuric acid corrodes aluminum to a slight extent, especially at elevated temperatures. The chemical properties of aluminum, therefore, make it particularly adaptable for use in the oil fields.

But aluminum cost more than iron and steel, and if aluminum is to compete with these materials, it must possess qualities which will balance or off-set its higher first cost. The cost of aluminum will vary between 28 and 45 cents per pound, depending upon the alloy used, and the cost of steel between 3 and 6 cents per pound.

However, steel is three times as heavy as aluminum, and on a volume for volume basis the aluminum would cost 9 to 15 cents. This is approximately three times the first cost of steel; therefore, for aluminum to be considered a commercial possibility, it must serve at least three times as well. Current tests in West Texas and the Panhandle indicate a life for aluminum lease tanks which will more than justify the higher initial cost.

In the following pages, a few of the applications of aluminum in the oil industry are given by way of illustration:

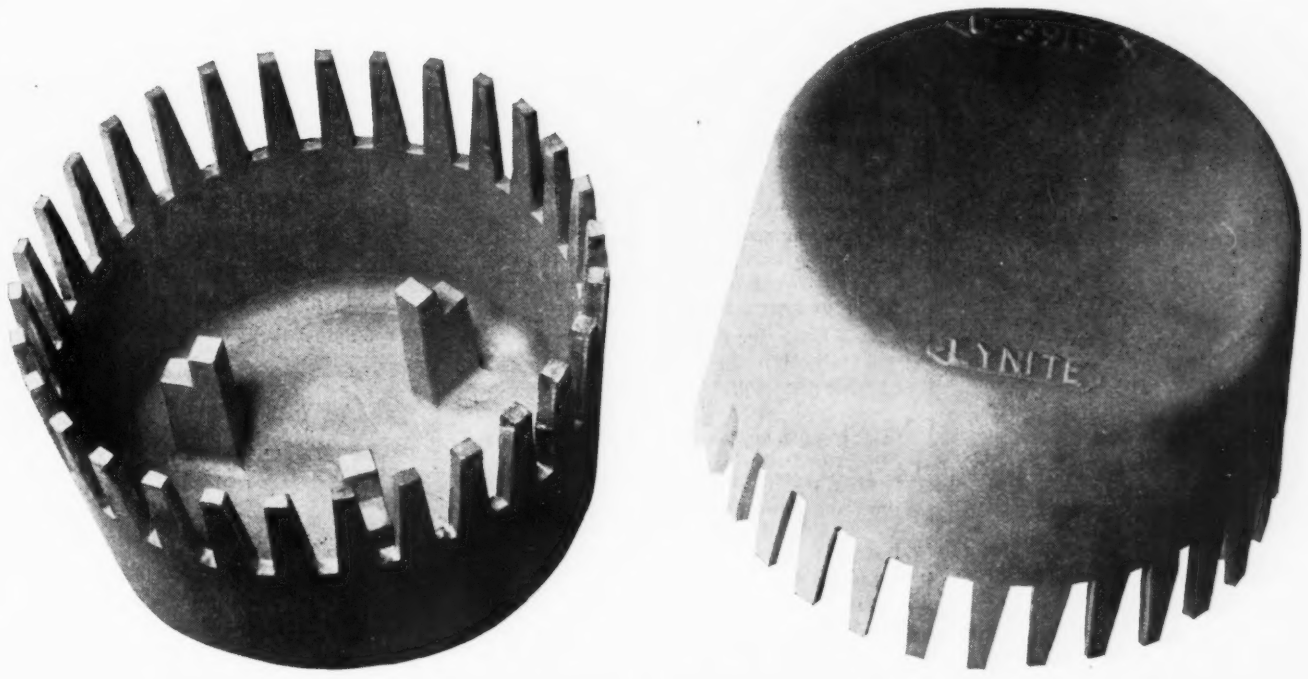
Aluminum Paint

A major use of aluminum paint has been in the painting of oil tanks. Steel tanks, thus painted, do not corrode as fast, and the evaporation losses are materially reduced. With certain paints, there is a tendency for the pigment to be eaten away by the corrosive action of sulfur laden gases. The life of the paint is, therefore, shortened.

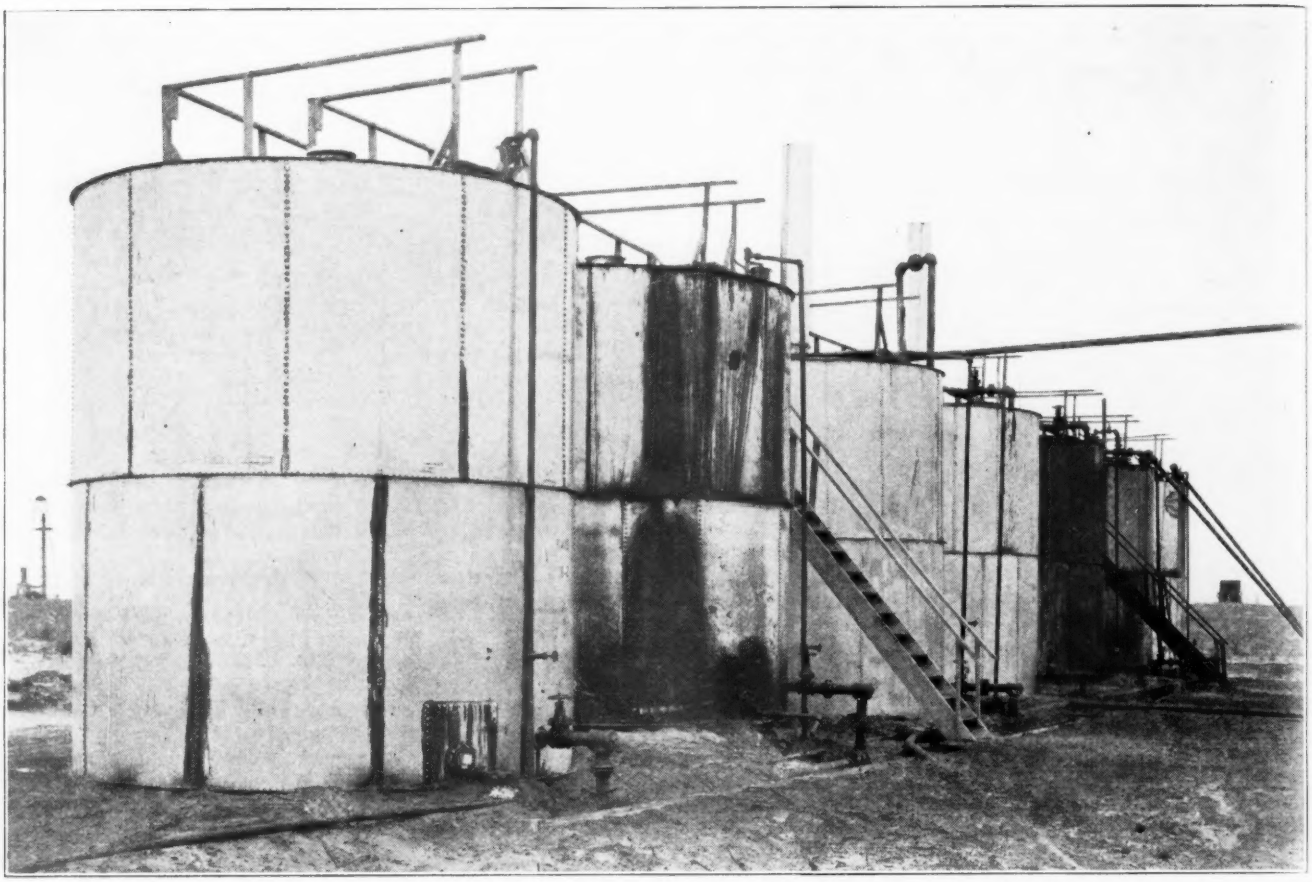
Since aluminum is not attacked by sulfur compounds, it will preserve the surface upon which it is placed for a much longer period of time. Besides being durable, it will not discolor and lose its excellent reflectivity of light.

The reflectivity of aluminum paint makes it particularly fitted for reducing evaporation losses within oil

*Aluminum Company of America, Pittsburgh.



Aluminum bubble caps, cast in sand from an aluminum-silicon alloy containing 5 per cent silicon



Battery of 500-barrel tanks on the State-Lassiter lease of Gulf Production Co., Crane county, Texas. At extreme left is all aluminum tank, and the composite aluminum-steel tank on the extreme right

tanks. About five years ago, the Bureau of Mines working in conjunction with the state of Oklahoma ran a practical test on the efficiency of various paints on oil tanks.[1]

Four 55,000-barrel storage tanks were employed in this test; they were painted black, red, gray and aluminum, as being the colors most used in the oil fields. The test ran throughout the year 1924. During this time, the average daily maximum variations in temperature within the four tanks were: black, 32 degrees Fahr.; red, 29 degrees Fahr.; gray, 25 degrees Fahr.; aluminum, 23 degrees Fahr. The volume and composition of the oil was determined each month. The results obtained are summarized herewith.

[1]Bureau of Mines Report, Serial No. 2677, by Ludwig Schmidt, March, 1925.

Aluminum Foil

In the days of wood aeroplane propellors, aluminum foil was employed as a protective covering. Today, it is applied with a suitable cement or varnish to the exposed surfaces of tanks and tank roofs, pipe lines and house roofs to preserve the steel or wood.

Experiments are being conducted at this time by some of the larger oil companies to determine the suitability of aluminum foil as interior and exterior protective coatings for steel tanks. These companies have several 55,000-barrel tanks, thus protected, and if the experimental tanks prove satisfactory there will undoubtedly be a much wider application of aluminum foil.

Due to the construction of tank steamers and barges, it is next to impossible to line the tanks with aluminum sheet once they are built, and to incorporate aluminum sheet lining in the tanks during the construction of the vessel would be very expensive. Nearly every known variety of coating has been applied to the inside walls of these tanks, but without much success. It has been suggested that aluminum foil be used for this purpose.

Aluminum Cable

Many oil companies are transmitting their power over aluminum cable, steel reinforced, due to the fact that it is more economical than copper and resists the corrosive action of sulfur vapors much better. The effect of hydrogen sulfide on both the electrical and mechanical properties of copper is well known. Since aluminum is not attacked by the chemicals found in the atmosphere around an oil well or refinery, and the steel reinforcing wires are galvanized and completely protected by the aluminum strands, aluminum cable, steel reinforced, has become standard with the leading producers. From the time the first aluminum cables were installed approximately five years ago, there has been no interruption of service due to failure of the cable.

All-aluminum cable is successfully used for swing lines inside of storage tanks.

Results of Bureau of Mines' Test on Evaporation Losses from Oil Tanks Painted Different Colors

Color of Tank	Initial Gauge Barrels	Evaporation Loss in one yr. Barrels	Evaporation Loss in one yr. Per cent	Loss in Gravity in one year A. P. I
Black	52,058	649	1.24	.6°
Red	53,294	609	1.14	.5°
Gray	53,192	547	1.03	.3°
Aluminum	53,418	447	0.83	.2°

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CONTINENTAL

Aluminum Roofing

Gatrel type roofs of 14 gauge aluminum sheet were installed on the wooden decks of two 55,000-barrel storage tanks during the summer of 1928. In the installation of these roofs, aluminum nails and rivets were also used. More recently several additional Gatrel type roofs have been installed, but of 20 gauge aluminum sheet.

While it is too early to judge the probable life of these roofs, indications are that aluminum will stand up much longer than the steel previously used for this purpose.

Aluminum Lease Tanks

Early in 1928 the Parkersburg Rig & Reel Co. and the Aluminum Company of America jointly decided to test out the feasibility of aluminum for bolted lease tanks. Two 500-barrel tanks were built, one tank entirely of aluminum and its alloys, and the other with the top ring and deck of aluminum and the lower ring and bottom of steel.

The tanks were installed March 20, 1928 on the State-Lassiter lease of the Gulf Production Co. in Crane county, Texas. This location was selected because the oil on this lease was particularly detrimental to steel tanks and equipment.

On April 15, 1929, the two tanks were opened, cleaned and inspected. The inspection party included not only representatives of the Parkersburg Rig & Reel Co. and the Aluminum Company of America but also Stanley Gill, corrosion expert of the Gulf Co. and Messrs. Schmidt and Devine of the Bureau of Mines.

At the time of this inspection the tanks had been in service 13 months without developing leaks. Adjacent tanks, in which new steel bottoms had been installed at the start of the test, developed leaks from corrosion within six months.

The all-aluminum tank had been handling oil containing over 30 per cent water; and the composite steel-aluminum tank, oil containing not over 1.5 per cent water. In this connection it should be remembered that West Texas crude oil is generally considered destructive to steel with or without water, but more destructive where water is present.

With the exception of a few blisters on the inside of the bottom, the all-aluminum tank appeared to be in substantially as good condition as on the day it was erected. At certain places on the inside, notably at the water line, there was a slight discoloration. In the oil zone, the material was in perfect condition. The same is true of the vapor space, rafters carlins and ladder as well as all of the outside surfaces.

The blisters on the bottom plates were thick skinned. The inside of the blisters contained both the typical white oxide and a black powder which appeared to be iron sulfide. This theory was substantiated by a chemical analysis of the black powder. Later, it was found that an iron pipe had been hung through the thief hole, and had remained in the tank for three or four months. This, accounted for the presence of most of the iron sulfide in the all-aluminum tank.

The excellent condition of the composite steel-aluminum tank at the time of this inspection would indicate that there was a tendency for the aluminum top portion to protect the steel bottom by removing the main source of sulfide scale. No evidence of galvanic action between the aluminum and steel could be detected.

Both tanks were closed as soon as the inspection had been completed. They have now been in operation approximately one and one-half years without developing leaks, or three times as long as the steel tanks in the same battery.

In addition to this test, the Bureau of Mines has recently erected three all-aluminum tanks at Borger, in the Panhandle. One of these tanks is of 500-barrel capacity, and the two other of 250-barrel capacity. The corrosive conditions at Borger are regarded as bad, and the effect of this extremely corrosive oil on aluminum will be looked forward to with interest.

Aluminum Bubble Caps

One oil company has successfully employed aluminum bubble caps in its refinery, and, on comparative tests, has decided to use aluminum in all future installations.

Aluminum Loading Racks

Aluminum tubing in iron pipe sizes has been used by a number of companies to connect the stationary outlets of gasoline loading racks with the inlet on tank cars. The tubing has to be lifted in and out by hand every time a tank car is loaded, and, for this reason, the light weight of aluminum tubing warrants its use.

HOUSTON—Natural gas production of Texas in 1928 amounted to 301,990,000,000 cubic feet, valued at 3.4 cents a thousand cubic feet at the well, according to figures of the United States Bureau of Mines. By contrast, the average value at point of consumption was given by the Bureau as 17 cents a thousand cubic feet. The report showed 420,000 domestic consumers using 27,284,000,000 cubic feet in Texas in 1928, at average cost of 67.1 cents a thousand cubic feet. Industrial gas consumption in Texas for 1928 was given as 291,434,000,000 cubic feet. As indicated by the figures given, a part of the Texas consumption was imported from other states.

HOUSTON—Pat M. Neff, former governor, who succeeded the late Clarence E. Gilmore as chairman of the Railroad Commission of Texas, which administers the state's conservation laws, occupied the executive chair for two terms, from January 1921 to January, 1925. He gained experience in railroad affairs as a member of the United States Board of Mediation, to which he was appointed by President Coolidge. His appointment had not been confirmed by the senate when President Hoover took office, whereupon former Gov. O. B. Colquitt was appointed in his place.

LOS ANGELES—One of the most active storage construction campaigns on the Pacific Coast in years has been that of The Texas Co. of California. It is nearing completion on the last 13 of a total of 43 steel storage tanks of 118,000 barrels capacity each. The total capacity of the new tankage mentioned aggregates 5,274,000 barrels.

New Patents

Prepared by R. E. Burnham, patent and trademark attorney, Continental Trust Building, Washington, D. C., from whom copies may be obtained at the rate of 20c each. State number of patent and name of inventor when ordering.

October 15, 1929

REFINING

Art of distilling hydrocarbon oils. Robert E. Wilson, Chicago, Ill., assignor to Standard Oil Co. of Indiana. Filed Jan. 15, 1925. No. 1,731,479.

Process for conversion or purification of hydrocarbon fluids. Heliodor Rostin, Charlottenburg, Germany. Filed Feb. 29, 1928. No. 1,732,111.

Process of removing amorphous wax from petroleum oils. Pierce M. Travis, Ridgewood, N. J., assignor to Travis Process Corporation, Jersey City, N. J. Filed July 16, 1927. No. 1,732,143.

Process of removing amorphous wax from petroleum oils. Pierce M. Travis, Ridgewood, N. J., assignor to Travis Process Co., Jersey City, N. J. Filed July 16, 1927. No. 1,732,144.

PRODUCTION

Core barrel. John T. Phipps, Huntington Park, Cal., assignor to H. C. Smith Mfg. Co., Whittier, Cal. Filed Nov. 4, 1926. No. 1,731,262.

Pipe-cutter. Ira J. McCullough, Walnut Park, Cal. Filed Feb. 1, 1928. No. 1,731,388.

Apparatus for cutting openings in deep-well casings. Godefridus H. C. van Keulen, The Hague, Netherlands. Filed Feb. 1, 1921. No. 1,731,553.

Multiple pumping-gear unit (for oil-well pumps). Leland F. Burnham, Pittsburgh, Pa., and Paul W. Jones, Los Angeles, Cal., assignors to Westinghouse Electric & Mfg. Co. Filed June 18, 1927. No. 1,731,885.

Method for perforating pipe or the like. Ira J. McCullough and Millard S. Black, Huntington Park, Cal. Filed March 15, 1924. No. 1,731,930.

Jack. James R. Thompson, Tulsa, Okla. Filed Aug. 24, 1926. No. 1,732,175.

MISCELLANEOUS

Liquid-measuring apparatus. Rene Porte, Levallois-Perret, France. Filed March 8, 1928. No. 1,732,063.

Method of building roofs for liquid-storage tanks and gas-holders. John H. Wiggins, Bartlesville, Okla. Filed July 5, 1927. No. 1,731,283.

Safety ventilator for oil tanks. Frederik Bernard, San Francisco, Cal. Filed March 7, 1928. No. 1,731,406.

Dispensing-pump. Paul B. Renfrew, Fort Wayne, Ind., assignor to S. F. Bowser & Co., same place. Filed Dec. 9, 1925. No. 1,731,681.

Quantity-recording mechanism for fluid-dispensing apparatus. Lee R. Hartley, Fort Wayne, Ind., assignor to S. F. Bowser & Co., same place. Filed Jan. 22, 1926. No. 1,731,744.

Liquid measuring and dispensing apparatus. James H. Williams, Fort Wayne, Ind., assignor to Wayne Co., same place. Filed Jan. 22, 1929. No. 1,731,805.

Crude Oil Supply in the Mid-Year, 1929*

By Howard S. Bryant
Geologist, Skelly Oil Co., Tulsa

FROM the viewpoint of the oil producer, the oil refiner, the oil marketer, and the investor in oil securities, a brief picture of the crude oil supply and demand in the present critical season of the year is thought to be timely and interesting. Oil companies and investors who appraise the prevailing economic factors correctly and guide their actions accordingly will be in the best position to realize profits this fall and winter.

Although crude oil production has been in a comparatively poor statistical position this year, increased sales and sustained refinery and crude oil prices have allowed increased profits for many oil companies.

The large amount of crude oil going into storage during the present period of peak consumption, just previous to the major yearly fall decline in consumption, has caused oil producers to make plans to leave the oil in the ground for the present in several of the areas of large flush production.

The present moment is looked on as the turning point in the current year.

Present Status of Crude Oil Supply and Demand

The total daily new supply of oil is now (a) about 3,410,000 barrels per day, made up of 2,970,000 barrels per day domestic production, 140,000 barrels per day of casinghead gasoline, and roughly 300,000 barrels per day of imported oils.

The present fall season consumption not only is the highest for the past fiscal year, but will probably show a new all time peak for the months of August and September. It is estimated that a volume of about 50,000 to 100,000 barrels per day of crude oil is being run to storage in this season of highest consumption.

The rate at which oil consumption plus exports has increased since early in January, the period of lowest consumption this year, has been rapid and slightly faster than the rate of increase in the years 1927 and 1928.

Although consumption has been considerably heavier this year than in 1928, it is pointed out that the net result shows additions to storage of 41,000,000 total barrels for the first seven months in 1929, as compared to 12,300,000 total barrels over a like period last year, over three times the amount of storage. The grand total of all oil storage stocks is at this time approximately 670,000,000 barrels.

The chart herewith shows graphically the relation of new oil supply to oil deliveries, with periods of over-production shown in solid black and periods of over-consumption in dotted areas. The amount of new drilling activity is shown by the number of new wells started each month, and an index of crude oil prices is shown by plotting the posted price of 35-35.9 gravity Mid-Continent crude oil.

It has been observed that there has been continuous over-production throughout the year 1929, while, for comparison, the year 1928 experienced drafts on storage throughout a four month period in mid-summer.

No period of withdrawals from storage this year is generally anticipated, even though the present shut-down programs in the few flush oil areas be carried out, due to an expected normal decline of about 300,000 barrels per day in consumption between now and the first of the year. Such a decline has been observed between the high and low points of consumption in the fall and winter season for the last three years. (b)

Although oil consumption in the first half of 1929 increased 9.1 per

(a) September 1, 1929.

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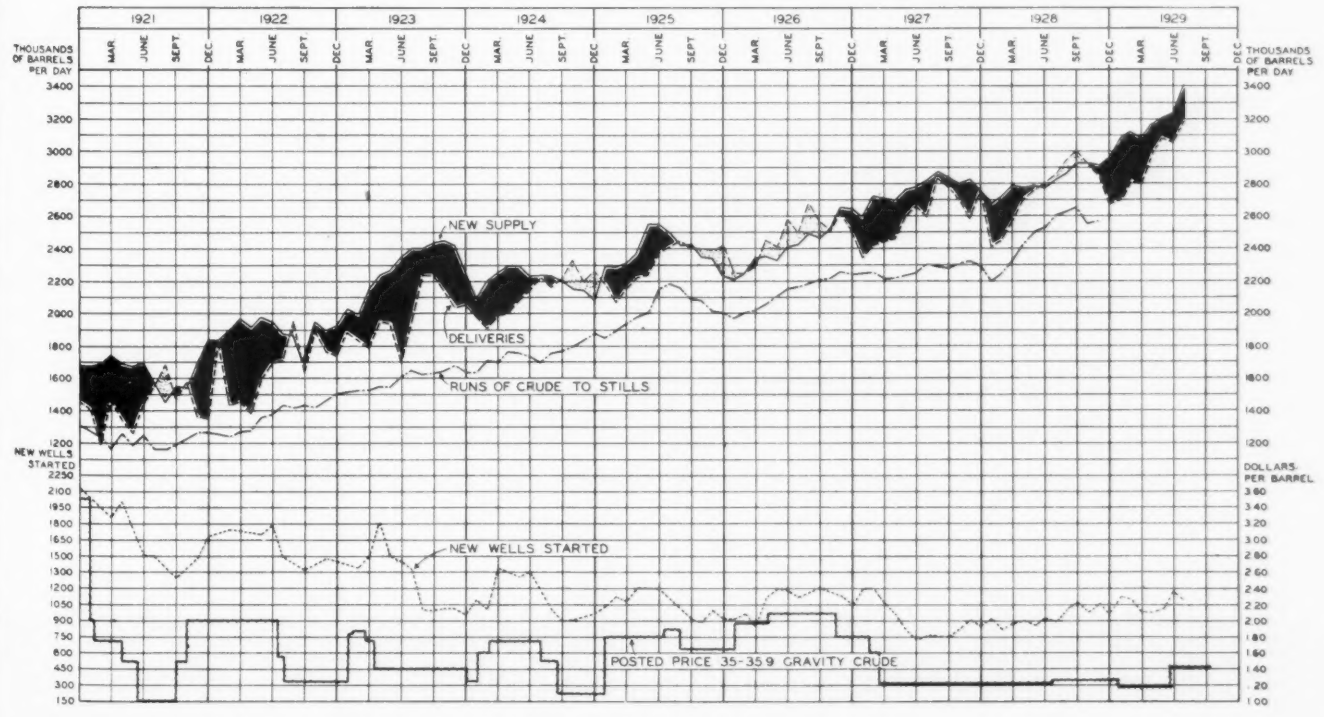
(b) Statistics are cited from the U.S.B.M. monthly petroleum Surveys, Dept. of Commerce, Washington, D. C.

TREND OF THE PETROLEUM SITUATION IN THE UNITED STATES



cent over the same part of 1928, production more than kept pace with it and increased 14 per cent over that part of 1928. It is again pointed out by the author, (c) in reference to the chart, that a good measure of stabilization has already been attained in oil prices and in the number of new wells started each month, the latter having gradually and regularly increased from June 1927, to the present time. Fewer profound changes in oil prices and the tendency to start about 1000 new wells each month, rather than 1300 one month and 900 the next month, characterize a practically new regularity and stability to the producing branch of the industry in the last two year period.

The importance of shut-in reserves is today considered just as vital as it was at the beginning of the year, although the potential production of the West Texas district has been reduced about 2,070,000 barrels per day on one hour gauges. The various other shut-in reserves in California, Texas, Oklahoma and Wyoming have not been drawn on appreciably in the past six months; such total volume if produced would be far beyond the capacity of the present oil market, it is thought.

In the critical season of the year when demand is low and additions to stocks are anticipated, more and more importance will be acknowledged to such factors as shut-in agreements and other forms of cooperative production projects.

That oil operators large and small are alive to the immediate possibilities of lessening their storage programs this fall and winter is attested by the shut-in programs now going into effect in the Texas Panhandle, in California, and at Oklahoma City, as well as the proposed programs in other possible flush areas.

Immediate Crude Oil Production In Sight

At the end of the first seven months of 1929, Texas and California lead the production of oil with about 870,000 barrels per day each, while Oklahoma was producing 730,000 barrels per day, its rate of production at the beginning of the year. Texas, which lead all states in production in 1928, started the year producing 720,000 barrels per day; California was producing 700,000 barrels per day at that time, and has shown the greatest increase in production of any state this year. These three major oil states produced 82 per cent of the United States domestic production in 1928.

Oklahoma

The Seminole area, now three years old, is still to be classed as probably the dominating factor in Oklahoma, although the new Oklahoma City field is considered by some as equally as important due to its huge potential production.

The present moment finds relatively small but highly productive flush areas in Seminole in Sec. 5, T7N, R7E, southeastern Earlsboro, Sasakwa, and in the Allen area, none of which are now producing more than 50,000 barrels per day each, but all of which help to maintain the very steady output of the district.

The present production of 410,000 barrels per day for the greater Seminole district, is practically the same as that district's production of 420,000 barrels per day at the first of the year, but remains as a substantial increase over the production of the district one and one half years ago.

The author believes that this rate of production can probably be maintained from present known prospective pools for one year, unless the operators take steps to regulate the output, because about 80 per cent of the above total output can be considered as settled production, which will have a slow decline; 50 per cent of such settled production is one and one half years old, or older.

The Oklahoma City pool, discovered at about the first of this year, now has 15 oil producing wells which produced a peak of 65,000 barrels per day on Sept. 9, before shutting in completely on Sept. 12 for a 30-day period, by order of the Corporation commission of the state of Oklahoma.

Although the great drilling depth of 6300 to 6500 feet demands from four and one-half to six months for the completion of a well, the initial production in several instances has been from 8000 to above 10,000 barrels per well, which together with the general high gravity of the oil secured, makes the drilling of wells attractive although their cost is reported at from about $135,000 to $150,000 each.

Before the field was shut-in engineers estimated that the field would have 19 additional completed wells in the above 30 day period, doubling the potential production to 130,000 barrels per day. Such additional potential will be held back for awhile because of the program adopted for delaying the drilling in of wells.

Kansas

Kansas began the year with 95,000 barrels a day of oil production, which rose to 140,000 barrels per day in July, due mostly to discovery of several oil pools in Sedgwick county. The largest contributor to the increased production is the Valley Center pool, discovery of which is due to the Marland Oil Co. through core drilling, and completing the discovery well for 1200 barrels per day one year ago.

This pool now produces 31,500 barrels per day from 100 wells, and to date has shown recovery of approximately 5000 barrels per acre, production being almost entirely from the Ordovician dolomite found at 3300 feet.

Resulting from the above development, the area of central western Kansas west of Sedgwick county has received the bulk of exploratory geological interest and leasing activity from operators in the northern Mid-Continent in the first part of this year. Twenty new wildcat discovery wells have been drilled in central and western Kansas in that time, showing the presence of oil over a broad general area, but up to the present time at least, in relatively small amounts, below the calibre of the Valley Center pool.

Texas

In the Texas Panhandle district a revival of drilling has taken place this year amounting to a second "boom," and the production has increased from 55,000 barrels per day at the first of the year to a high of 135,000 barrels per day average for the week ending Sept. 5.

Of the above, 80,000 barrels per day of new production, 75,000 barrels per day are coming from a relatively small number of new granite wash wells in Gray county; these alone have shown a decline of around 7000 barrels per day each week for the last three weeks.

By holding back the present drilling wells to Oct. 1, or a little later, the operators are confident that the production will be reduced to an amount that can be handled by the pipelines out of that area. The number of new well locations made each week is less and less, indicating slackening activity.

The above mentioned rapid decline is expected to steady down to a settled basis before very long, as the older wells in that pay have shown fairly good staying power.

Although diminishing in amount somewhat from last year, West Texas has shown considerable activity. In September, 1929, all West Texas was producing 375,000 barrels per day, an amount of 25,000 barrels a day more than the production at the beginning of the year.

Transportation facilities in this region will probably be further extended during the coming year, but it is felt that the operators there will be willing to do their share toward restricting the crude output, if necessary, because the most effective proration of 1928 was practiced in that district.

The Yates pool and the Howard-Glasscock areas have seen minor extensions in the last six months, and production from the former is now 60,000 barrels per day more than at the first of the year, making the production about 135,000 barrels per day, made possible by additional pipeline facilities.

The Hendricks pool has declined from 175,000 barrels per day to 130,000 in the same time and now rates in second place to the Yates pool in production. The industry has seen the potential production of the Hendricks pool based on hourly gauges reduced from 2,660,000 barrels per day at the beginning of 1929, to the present potential production of 330,000 barrels per day.

The potential of the Yates field has shown no appreciable drop in recent

(c) Bryant, Howard S. "The Crude Oil Supply" A.I.M.E. Feb. 1929, p.3.

months, although there has been a small increase in the water production. In the Howard-Glasscock area partial proration is still practiced under the supervision of the Texas Railroad commission; this has now been in force for one year, but does not serve to reduce production in a large way, as present production is 30,000 barrels per day, and the present potential only 35,000 barrels per day.

The discovery well O'Brien No. 4 of the Gulf Oil Co. in Ward county, which came in producing 1,364 barrels per day initially, is showing prospects of another major pool, along the Hendricks-Ft. Stockton trend.

A new Pecos county discovery well, the Rowan and Tong No. 1 McDonald shows prospects of opening a major lime-pay pool from its initial flow of 240 barrels in two hours and 40 minutes. Other notable recent discoveries of expected smaller calibre have been brought in in the Taylor Wink area, also in Pecos county, and in the Penn-Bennett areas in southern Ward county. It is felt that at least one major pool will probably be developed from these several discoveries.

The new field at Salt Flat in Caldwell county, southwest Texas, is still producing not far below its peak of 52,000 barrels per day set three months ago in the middle of June. Since the discovery well was completed in October, 1928, the field has produced about 9,500,000 barrels from the Edwards limestone. Other wildcat tests drilled southward along the Balcones fault zone and subsidiary faults in Guadalupe county show appearances of another separate new pool or two, in addition.

The Wichita Falls area in north central Texas has recently shown a 15,000-barrel per day gain in production and the Gulf Coast salt dome region has seen several recent new discoveries and its already proven areas drilled to the extent of increasing its production by about 25,000 barrels per day. In review, all other producing districts of Texas show larger or smaller gains so far in the present year.

New Mexico

Drilling activity in southeastern New Mexico across from the Texas line has been carried on during the year over a fairly broad area, with the result of outlining a huge natural gas reserve, and finding two important appearing oil producing areas. The Hobbs area has the appearance of becoming a major pool when considerable further drilling takes place. The Jal area in the far southeast corner of the state has several widely spaced producers at the present time, and will see further and continuous proving up in the winter and spring of 1930.

California

California has shown the largest increase in production among all the oil producing states this year. This has come about largely due to drilling wells deeper to the O'Connell and Clarke zones in Santa Fe Springs field, in the Los Angeles basin.

This field is unique in the annals of deep production because 75 per cent of its present production of 275,000 barrels per day comes from depths of 6800 feet to 8000 feet. The field averaged 154,000 barrels per day in January of this year, when the deep drilling campaign was started. The present activity shown in developing the third Clarke zone classes this zone as the greatest production factor in the state at present. Under the terms of the new gas law now going into action, such activity is expected to be markedly lessened.

Long Beach is holding to within 10,000 barrels per day of its production at the first of the year, and will probably show the same steady characteristics for some time in the future.

Kettleman Hills is expected to have operations practically entirely shut down for a two-year period, if the present curtailment program now awaiting final signatures goes into effect. This huge reserve is about half United States government domain and the Department of the Interior has been instrumental in having the new district set aside as a reserve for the future. This program plans to allow the few wells already started to be completed, and such few wells will probably not add much to California's total production in the remainder of this year.

The new state gas law in California is believed to be a far more stringent measure than has ever been passed by any oil production state in this country. In essence the law forbids the waste of gas energy, and very simply states that blowing gas into the air is evidence of such waste. Unanimous sentiment of the major producers is back of the new law. There will no doubt be difficulties found in enforcing this law and a certain length of time will be needed to arrange the detailed operations in the various fields.

The law is aimed at the wastage of an estimated 900 milion cubic feet of gas per day in the state, 600 million of which is coming from Santa Fe Springs, Long Beach, and Ventura pools. If half of the latter amount of gas waste were to be eliminated, it is conservatively estimated that 100,000 barrels per day of oil would necessarily be curtailed. There seems to be reasonable expectation that such action will take place in October or November this year.

Present Is Season of Largest Demand

Oil consumption statistics for the months of August or September will undoubtedly show a new peak in the neighborhood of 3,300,000 barrels per day. This figure is expected to show a drop of about 300,000 barrels per day by the end of this year or in the month of January, 1930.

Such general high consumption throughout the first half of the year coupled with generally high average prices for refined oils enabled a large group of the major companies to show about 75 per cent greater earnings than in the same period of 1928.

Although demand is at its highest point, it is felt that when such peak has been passed, then the responsibility of holding or reducing crude prices rests with the operators who have it in their power to pro-rate production to approximately the market's requirements. It is suggested, also, that California prices would probably have been lowered before this time but for the impending adoption of their new gas law, and the consequent reduction of crude output coming thereunder.

The Mid-Continent situation since the spring of this year has been considered somewhat stronger than that in California. It seems a fair assumption that the Mid-Continent refiners and its markets have not been harmed by the present excess production in California nearly so much as if that uncontrolled overproduction were from the Mid-Continent area itself.

The Present Outlook

The number of new wells located per month is at the highest figure in the last two years. General slowing down of wildcat drilling activity is one of the biggest aids in solving the psychological problem of over-production, and should be in evidence after the consumption peak is passed this fall.

A wildcat pool opener generally has its worst effect on the crude oil market, given an already weak situation, before the field is developed and when its potentialities are little known. One wildcat producer may have the same effect in such a situation as the drilling of 25 or 50 proven well locations. That is an argument for a stop on drilling wildcat wells in times of strain in the crude market.

The movement toward conserving the country's oil resources and producing those resources economically when wanted, gains definite headway, regardless of temporary setbacks. The leaders have now largely come to the attitude of giving it strong support, and are yet only concerned as to methods and practices.

California is making definite progress with her problem, Oklahoma City operators have already shut in their field entirely, Texas Panhandle drilling is being slowed down, and possible additional shutting in is being considered in the West Texas and the Seminole districts.

If our present production rate continues to the end of the year, the winter drop in consumption will occasion storing about 400,000 barrels per day. If the several proration programs now under way perform a reasonable reduction in daily output in those critical flush oil areas, the coming seasons at the end of this year can be viewed with confidence that supply will not exceed demand beyond the average normal winter volume.

Marshall Pool Owes Long Flowing Life To Proper Use of Pressure

By John Power
N. P. N. STAFF WRITER

TULSA, Oct. 28

IN VIEW of the drastic steps necessary to restrict development of flush fields under competitive conditions, the Marshall pool of Logan county, Oklahoma, stands out as an interesting example of what can be accomplished along conservation lines under unit control.

As applied to this pool, unit control means the ownership by one company of the great majority of the acreage, with the leaseholds in fairly solid blocks. The principle of unit control is equally as effective in controlling development where it is secured through partnership agreements entered into before the development gets out of hand.

Marshall is Oklahoma's first 6000-foot pool. Until the Oklahoma City areas was discovered, Marshall held the palm as the state's deepest oil field. It has had to take second place now as regards depth, but the history of the field has been such as to keep it well to the fore in the list of pools developed under methods and conditions best designed to promote orderly exploitation, and the greatest possible recovery of oil.

Under the operating conditions which have prevailed in the Marshall pool it has been possible to conserve to a large extent the natural rock pressures found in the sand originally. Pressures which ran as high as 2000 pounds when the field was discovered more than two and one half years ago have fallen but 200 pounds on wells now being completed. This is a decline of 10 per cent in initial rock pressures in more than 30 months, which is considered to be satisfactorily slow.

Under the ordinary style of highly competitive development which usually follows the discovery of oil in large quantities, the wells quit flowing naturally soon after they are completed. This is particularly true of wells drilled in a little later than the general run, as the rock pressure is depleted so fast that these wells are robbed of the gas pressure by those completed first, which are allowed to produce at atmospheric pressures continuously after completion. Unless artificial flowing means are resorted to the wells soon go on the swab, and shortly thereafter on the pump.

By using to the fullest extent the natural force of the gas found with the oil a much greater portion of the entire amount of oil in the reservoir is recovered at a low expense. With only a few operators to take into consideration it has been comparatively easy for agreements to be reached which would keep the locations to be drilled to the desired minimum and the back pressures carried to a satisfactory maximum.

As it now stands the Marshall pool contains roughly 900 acres which may be considered proven. Of this amount the Shell Petroleum Corp. owns a little better than 75 per cent. As seen from the accompanying map much of the Shell's acreage is in leaseholds larger than the usual 40 or 80-acre tract commonly found throughout the Mid-Continent.

Aside from the remarkably few wells which have been drilled in an area where individual producing wells have had initial productions higher than 5000 barrels daily, and where some of the wells have had a total recovery in excess of 1,000,000 barrels, perhaps the most important feature of the exploitation of the field has been the regulation of the gas/oil ratio through back pressure.

EVERY effort has been made to keep the gas/oil ratio as low as possible, and that these efforts have been successful is evident from the fact that every well in the field is flowing naturally.

That goes also for the discovery well, which is two and one half years old, has produced a total of more than 1,300,000 barrels of oil, and had an initial production of but 2896 barrels per day. The well is the Shell No. 1 McCully, SW NE SE of 30-19N-4W, completed May 8, 1927, in the Wilcox sand found at 5980 feet. But five feet of pay was drilled and as the well began to flow vigorously, the tools were pulled up the hole a few hundred feet, where they have stayed to this day. They have never been touched, the wire line having been hung on the clamps and the tools left swinging. This is one of the four producing wells in the field which has not been back pressured through choking one way or another, the presence of the tools in the hole being considered sufficient hindrance to the flow of oil. The well is still flowing naturally at the rate of 260 barrels per day.

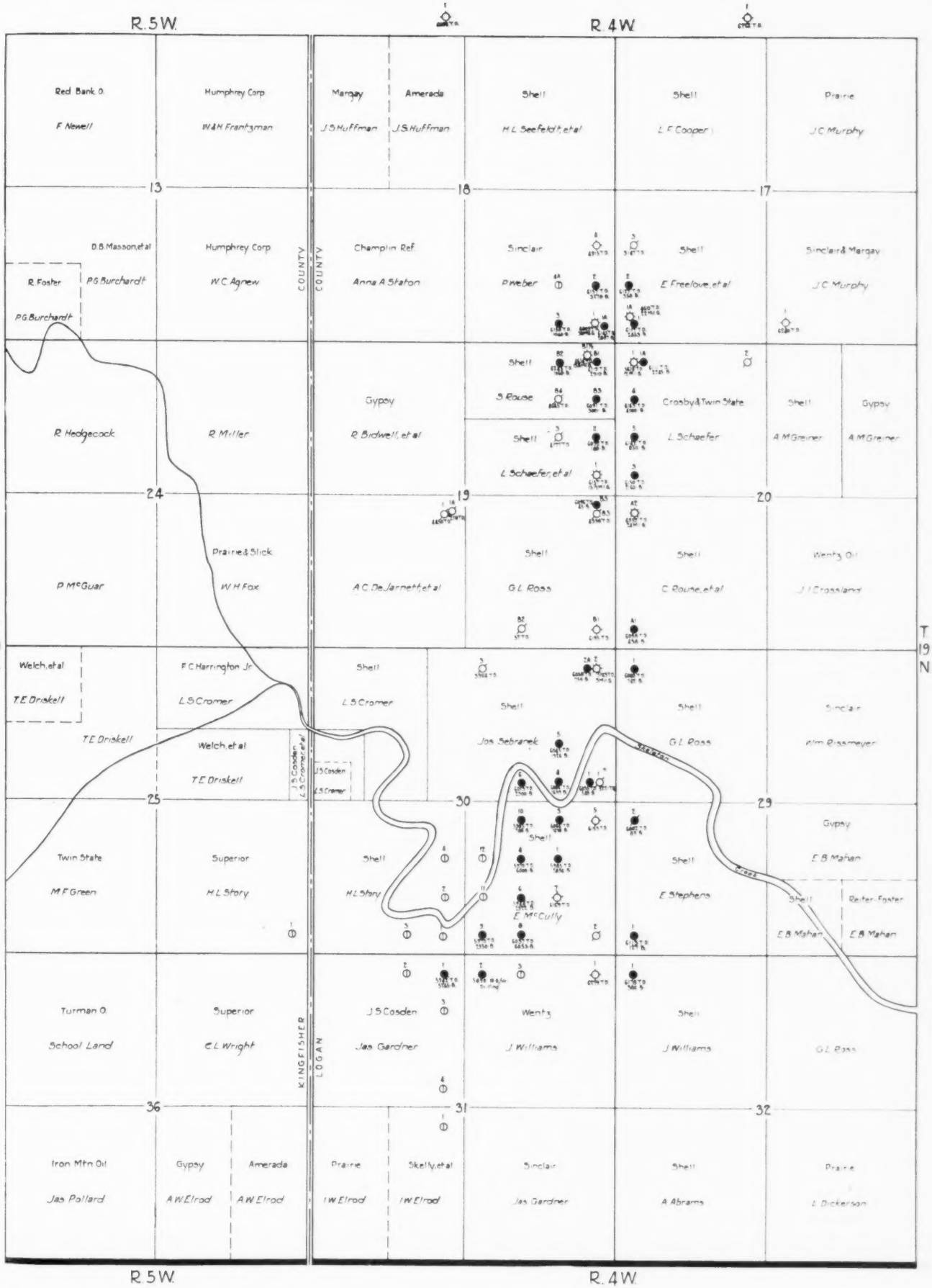
Another example of what has been accomplished by a full utilization of the natural propulsive agent in the oil is the Shell's No. 1 Williams, which was completed Jan. 16, 1928, for an initial production of but 256 barrels. There was 208,000 cubic feet of gas per day with the oil. At first glance it would seem almost an impossibility to make a well as small as this pay out from a depth of 6000 feet, but by choking the well, and those near it, the well has been made to produce a total of 111,000 barrels of oil to date. Present average daily production is 99 barrels per day, natural flow.

ON THIS well tubing was run immediately, and the back pressure carried on the well by choking the tubing. Two methods of carrying back pressures are practiced in the pool, depending on the size of the wells when completed. On the smaller wells tubing is run and the well choked through the tubing. On the large wells choke nipples are installed on the flow lines.

With gas and gas pressure the highly fugitive, elusive things they are, it is necessary of course that back pressure and gas/oil ratio control be applied throughout the field. One or two wells blowing open would soon deplete the pressure all over the field to such an extent it would be impossible to flow any of the wells for long.

In order to maintain the most efficient gas/oil ratios on the producing wells, initial productions have been cut as much as 30 per cent. A cut in initials over the field of 10 per cent has been the average. Although back pressures vary over the pool, on many wells it runs as high as 200 pounds on the choke. On wells which are being produced through the tubing gas pressures on the casing of as high as 700 pounds are common. Along the southwest edge of the present development all the operators are maintaining average back pressures of some 110 pounds, to the mutual satisfaction of all concerned.

Since the opening of the field every effort has been made to reduce and control the gas/oil ratios on all wells. Cuts of as high as 35 per cent have been made on some of the wells, with the average over the field running around 10 per cent. On some of the



Under unit operation in this pool, since its opening great care has been taken to reduce and control to the most effective point the gas-oil ratio of all wells drilled in. With the ownership of most of the acreage in the hands of one company, it has also been possible to see that only necessary wells have been drilled. Where initial productions have run in excess of 5000 barrels daily, in 30 months but 66 active locations have been or are being developed

earlier wells gas/oil ratios were about 1500/1, that is, 1500 cubic feet of gas was produced with every barrel of oil brought to the surface. On the wells completed more recently the gas/oil ratio has been higher initially, averaging around 2500/1, but the same care has been taken to reduce the ratio on these wells, despite the fact that a cut on these larger producers meant a considerably greater number of barrels reduction in production. A greater gross recovery and a much longer natural flowing life was considered sufficient justification.

Although particular attention has been paid to conserving the natural rock pressure throughout the field, a slow and orderly development campaign has also been carried on. A control of gas/oil ratios, which has become an accepted method of increasing the total recovery from any new field, is possible in pools developed under competitive conditions, as most oil operators are willing to reduce their daily production a little to increase the total yield from their properties.

But getting oil operators to reduce the number of wells they want to drill in a newly discovered area is something else again. The heritage of all oil men is speed, speed, and more speed. The natural inclination is to drill up all leases first, and talk proration or restriction afterward. With a big investment in wells drilled, it is only natural that any movement which delays the return of the drilling investment is looked on with more or less dissatisfaction. It has taken the oil industry a long time to get in accord with the idea of controlling the gas/oil ratios.

But in the Marshall pool where there are few operators, and with the ownership of the big majority of the good looking acreage in the hands of one company, it has been possible to arrange that only such wells as were strictly necessary be drilled. In some 30 months but 66 active locations have been or are being developed. Of these 35 are now producing, 13 have been dry, and the rest are in various stages of drilling. Six gas wells have been completed.

The 35 producers are making a total daily average production of 14,436 barrels. Of this amount the Shell has 12,772 barrels from 27 wells. There are two pays in the field, though one of them does not amount to much. At about 5960 feet there is 10 feet of oil sand which produces some light wells, but in itself is not sufficiently productive to justify drilling wells to such a depth. Immediately below this pay there is a hard sand break which is dry, while just below the break lies the Wilcox sand. The latter is the pay off, turning in several wells with initials of better than 5000 barrels daily. This rich streak has not been drilled very far, most of the wells going into it a matter of five feet or so and quitting there.

Up to June 14, 1929, the trend of development has been northward from the Shell's McCully lease, on which the discovery well was located. Since the completion of the big producer of J. S. Cosden in the NE NW of 31-19N-4W, on the southwest flank of production, the development has been getting under way in this direction.

The same plan of slow drilling, and controlling the gas/oil ratios is being followed in the new section of the pool as has been described in the northern part of it. For six months prior to the drilling of the Cosden well development throughout the pool was practically at a standstill.

Predicts High Failure Rate in Kettleman Hills Field

THAT 25 per cent of the wells that will be drilled in the Kettleman Hills field, Calif., will be failures because of mechanical trouble is the startling assertion made by E. H. Musser, deputy state oil and gas supervisor of California, in a preliminary report on the field, published by the state in October.

"Drilling of new wells is done exclusively by rotary," said Mr. Musser. "The equipment in every case is as heavy and substantial as it is possible to obtain. At present both steam and electricity are in use for power.

"The drilling machinery in use is of three general types: (a) Straight drive rotary; (b) Hild differential drive; and (c) Doheny-Stone hydraulic drill. So far it is not possible to say which will prove to be the most satisfactory.

"The most common casing program at present is 20-inch or 18⅝-inch, 11¾-inch or 13⅜-inch, 9-inch or 8⅝-inch. The latter will be the final water string unless unforeseen trouble is encountered. Whether an oil string is used will depend on results obtained in the first wells completed. Indications are that an oil string will not be necessary unless it is desired to cement or blank off a portion of the oil zone.

"The wells are being drilled in accordance with a plan of one well to 20 acres with a staggered effect.

"Hazards of drilling are numerous. Trouble begins with loss of circulation at depths ranging from a few hundred feet to 2000 feet. These depths are not uniform, so it does not appear that the loss is in any single stratum. Surface strings are usually cemented in the neighborhood of 1500 feet, which is below most of the lost circulation depths. One company, however, has had trouble to about 2000 feet after landing this upper string.

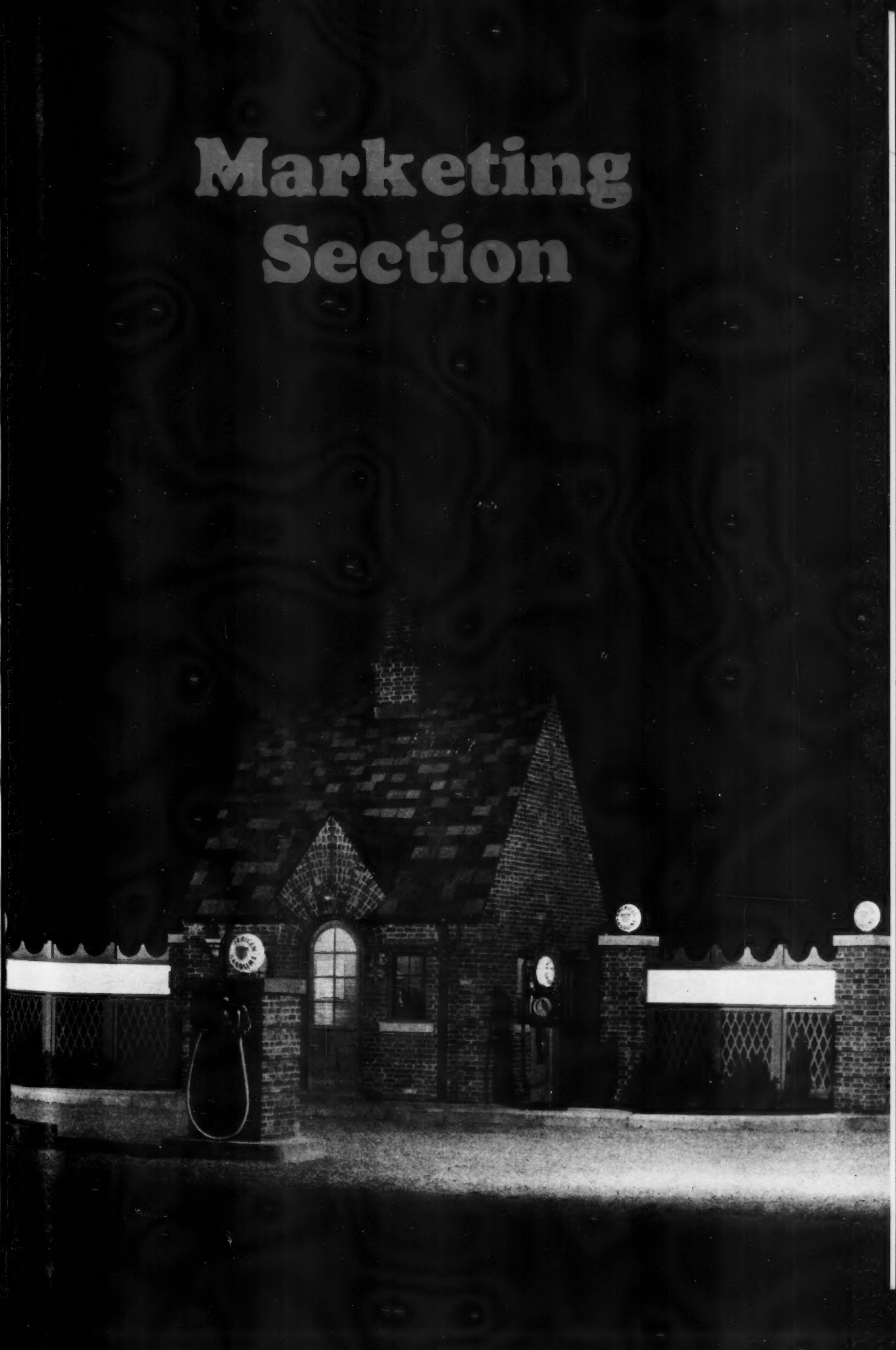
"Most of the wells have not yet reached the next troublesome depth, which is in the Brown Shale from about 5000 feet to the top of the Temblor at 6300 feet. Here considerable gas pressure, combined with a shale which tends to cave, makes progress uncertain. Another difficulty is the strong flow of water at about 5300 feet which will probably be found in some of the wells. In the General Petroleum Corp. of California wells in T. 22 S., R. 18 E., this water flowed up through a full column of mud and built up a pressure of 1800 pounds per square inch when closed in. In the General well No. "Ochsner" 2, Sec. 26, T. 22 S., R. 18 E., this water started to flow about the time the drill pipe was pulled out and continued until fresh mud was pumped in. At present the water is cased off back of the 6⅝-inch casing cemented at 6502 feet, but is flowing steadily between the 6⅝-inch and 8⅝-inch casings.

"Below 6300 feet in the Vaqueros formation the drilling is extremely hard, and in some cases this will undoubtedly cause the drill pipe to twist off. High gas pressure will also be encountered and altogether the drilling is fully entitled to the term 'hazardous.' Various guesses as to the number of successful completions of wells have been made. The writer believes that probably 25 per cent will be failures due to mechanical troubles and certainly some more due to lack of oil.

"The problem of production will consist in determining the proper size and depth of tubing and flow orifices, assuming that all the early wells will flow. The result desired will be, of course, to hold the gas production to a low figure. This will be desired for two reasons: First, because all the gas probably can not be utilized; and, second, to hold the gas in the ground to increase oil recovery. By the time the first wells are completed, a market for some of the gas will probably be opened, but almost certainly not for all that will be available.

"Costs of drilling are high, although perhaps not excessively so for the depth obtained. The average cost of new wells will probably be in the neighborhood of $250,000 each, although this figure might be slightly less or considerably more. The initial cost of derrick and outfit is high, because of the hilly ground and heavy material needed. The depth requires extra heavy casing and other equipment. The isolated location increases labor costs and transportation. In fact, nearly everything costs more than it would in any other California oil field."

Marketing Section



Light Semi-Trailer Is Chief 1929 Development in Oil Hauling

By Roger B. Stafford
N. P. N. STAFF WRITER

CLEVELAND

THE light semi-trailer method of hauling gasoline and oils has been the outstanding transportation development in the oil industry in 1929. Here is how the light semi-trailer was developed through the ages:

Some astute mind in prehistoric times perceived that an animal could pull a heavier load than it could carry or push, hence the horse-drawn vehicle, after one of our early inventors designed the wheel.

When the motor truck came into existence it carried its load on its own back and pushed itself and its load along through power applied at the rear axle. When efficiency experts, collaborating with automotive engineers, sought to increase the load, it was necessary to resort to the trailer because limits to loads carried were imposed by engineering and physical laws.

Following the trailers came the semi-trailer, a more flexible unit which permitted the use of lighter power units than the truck with four or six-wheel trailer, thereby reducing the initial investment in the equipment.

In gasoline and oil transportation, trailers and large semi-trailers came into use several years ago but it was not until early this year that the semi-trailer was applied to the 750 to 1000-gallon capacity requirements.

The idea for the small semi-trailer equipment jobs is credited to A. W. Kenerson, who took charge of the automotive department of the Standard Oil Co. of Ohio after years of service with the White Motor Co. as technical service manager. This activity brought him into contact with the transportation problems of fleet operators, particularly the petroleum group.

To S. A. White, purchasing agent of the National Refining Co., Cleveland, is credited the turning of the oil industry's attention to this light type of semi-trailer gasoline and oil transportation equipment. Mr. White held a series of hill climbing tests with semi-trailers last spring. These tests attracted wide attention.

A. W. Kenerson, manager of Standard Oil Co.'s automotive transportation, who pioneered the light semi-trailer method of hauling gasoline and oil

The Standard of Ohio has put in service 156 semi-trailer tank units and several semi-trailer stake units since the first of March, the National Refining Co. has more than 40 in use and Refiners Oil Co. of Dayton and Tide Water Oil Co. more than 20. Other users include Humble Oil & Refining Co., Shell Petroleum Corp., Cities Service Oil Co., Pure Oil Co., and Louisiana Oil Refining Corp.

Asked at a meeting of the A.P.I. Committee on Automotive Transportation last June why the Standard of Ohio had adopted the semi-trailer method of transportation Mr. Kenerson explained in substance:

"Application of the trailer to the transportation problem had its inception in the desire of the operator to move more pay load than could be moved on a truck of the available capacity. As a result the tractor-trailer combination was developed, making it possible to move 10 to 15 tons, wherein five was the maximum previously. This new practice proved to be economically sound. In the case of the light semi-trailer we are just applying this principle to a lower scale. We are using lighter power units than we could if we used standard trucks of comparable capacities."

The Standard of Ohio has in service 116 750-gallon tanks mounted on Fruehauff drop-frame semi-trailers. All tanks except three experimental jobs are of the Davis make. The truck type tractors are GMC's, Indiana's and International's of 1½-ton rated capacity. Figuring the gasoline and tank at eight pounds per gallon, the load on the semi-trailer is 6000 pounds—three tons. These units replaced 650-gallon tank trucks with 2-ton chasses.

It has twenty-four 1000-gallon Heil tanks on Freuhauff semi-trailers drawn by light 2-ton truck tractors. These jobs replaced 2½-ton trucks. It also has twelve 2000-gallon Columbian tanks in service station gasoline delivery service which are drawn by 3-ton truck tractors. All of these 156 semi-trailer jobs have drop frames.

The company has in its industrial lubricating oil delivery service in Cleveland four 1000-gallon, two-compartment, semi-trailer tanks and seven 6-ton stake trucks. Only four tractors are used in hauling these 11

A 2000-gallon outfit unloading gasoline at a Standard Oil Co. of Ohio service station. This large delivery unit is daily in the city's heaviest traffic

jobs. Formerly in this service 16 stake trucks were used. Now it is possible for the four tractors to keep constantly on the move while the tanks or stake trailers are being filled or unloaded. White 2-ton truck tractors are used.

The Standard of Ohio also uses fifteen 15-barrel stake semi-trailers, each of which has its own 1½-ton tractor. The pay load on these jobs averages approximately 6750 pounds.

The company's semi-trailer fleet is completed with three 2700-gallon tanks to which are coupled 1800-gallon four-wheel trailers, making a pay load of 4500 gallons. These jobs are used in bulk station haulage.

The wheel base of all semi-trailers with 750 and 1000-gallon tanks is 110 inches and the tractors have wheelbases of 127 to 137 inches, making overall wheelbases of 237 to 247 inches.

The 2000-gallon jobs have trailers with 150-inch wheelbases and tractors with 140-inch wheelbases, a total of 290 inches. The short wheelbases are made possible by the use of drop frames. The three large trailers with 2700-gallon tanks have wheelbases of 216 inches for the trailers alone or 67 inches more than the semi-trailers for the 2000-gallon jobs.

The shortening of the wheelbases increases the maneuverability of the jobs. The 750 and 1000-gallon units are able to turn around in a 14-foot road. In a demonstration conducted some time ago by the National Refining Co. a 750-gallon semi-trailer drawn by a Ford tractor was able to turn around in a farmer's lane although a car of 134-inch wheelbase had to back out.

The Standard has pneumatic tires on all the 750, 1000 and 2000-gallon jobs. The stake trucks also are equipped with pneumatics all around.

Road speeds of 25 to 30 miles an hour can be maintained by the smaller semi-trailer units but speeds of the 2000-gallon units are held below that rate.

The 2000-gallon jobs in filling station delivery service in Cleveland made as high as nine trips with full loads last summer and traveled 60 to 75 miles per day.

Delivery is also speeded up by large outlet lines. The 750 and 1000-gallon tanks have 2-inch discharge lines and the 2000-gallon tanks have 3-inch lines. Discharge is by gravity from all sizes of tanks. The two smaller sized tanks have four compartments each but the 2000-gallon tanks have five.

IN DESCRIBING the 2000-gallon units in the Sohioan, the Standard of Ohio's house organ, Mr. Kenerson wrote:

"This piece of equipment is very easy to maneuver in and out of our most inaccessible service stations, due to the fact that the tractor is 140-inch wheelbase and the trailer 150-inch wheelbase, the short wheelbase of the trailer being obtained by use of the drop frame construction, which makes possible the use of a larger tank oval, thereby obtaining the capacity in the shorter length. This also develops a very low center of gravity, making the equipment very safe to handle on curves at a fairly high speed, there being no tendency to side sway. To appreciate this length, it might be well to state that our 'Big Bertha' of 2700 gallon capacity,—an increase of only 700 gallons,—has a trailer wheelbase of 216 inches,—very materially increasing the turning radius which seriously affects maneuverability.

"A feature of the tractor-trailer equipment is the flexibility provided in all directions by the fifth wheel at a very critical point in the construction, viz., the end of the tank. One of the serious problems that the operator of 4-wheel type tank trucks has to contend with is frame breakage. This is due to mounting a tank—a rigid member—on a frame designed to flex under road variation stress. This practice localizes the flexing of the frame at that point between cab and tank, which in 90 per cent of the cases is the cause of the difficulty; this is eliminated by tractor-trailer flexibility.

"The tank mounted on a semi-trailer is further removed from the hot exhaust pipes and other heated surfaces. The outfit is also equipped with six wheel brakes,—the tractor manufacturer providing four wheel brakes; the trailer being equipped with BK booster brakes operating simultaneously with the tractor brakes, which makes it possible to operate the unit at higher speeds and with increased safety, which is so necessary in the congested areas where it operates most of the time.

"The trailer requires very little attention from the maintenance standpoint. The tractor can be uncoupled from the trailer and run into our shops as a separate unit, thus increasing the productivity of our shop floor space, due to much less area being occupied. Furthermore, the rear axle and brake mechanism are all exposed, facilitating brake adjustment, lubrication, etc.

"There are a great many small details which in the course of a day's operation very materially influence the daily average gallonage of a unit of this kind, such as, the time required at the filling rack, the time on the road between shipping point and delivery; also the time required to make the dump. This unit is equipped with

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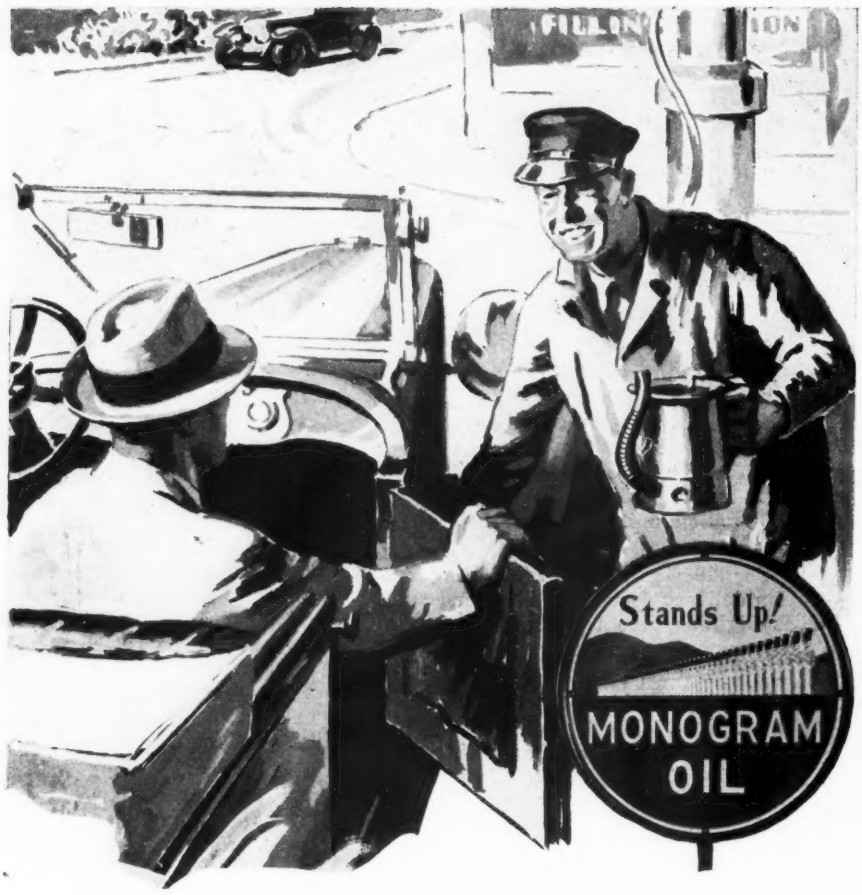

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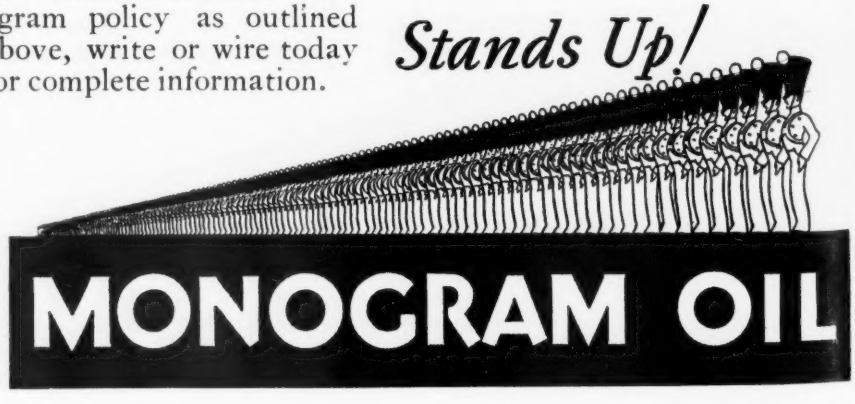


3-inch piping, quick opening gate valves, and Barrett automatic couplings,—all of which very materially reduce the unloading time.

"Furthermore, the use of a 3-ton tractor, pneumatic tire equipped, as a motive power, permits operating at speeds considerably in excess of that possible with the heavy duty equipment, reducing the time on the road,—a very vital factor."

The cost of the semi-trailer units runs 25 to 30 per cent less than trucks with tanks of the same capacities. Depreciation is chiefly on the power unit and some companies are figuring on only a 10-year write off on the trailer and tank assembly. Although accounting practices may call for writing off in a shorter period, automotive men believe the equipment will outlast the 10-year period.

Because the smaller sizes of semi-trailer equipment were introduced only this year, it is impossible to give comparable operating and maintenance data. Figures that will be comparable with those compiled by oil companies for their standard truck units will not be available for two or three years.

C. F. Bertschinger, supervisor of motor equipment of the Tide Water Oil Co., said recently the semi-trailer equipment has demonstrated that it is more economical to operate than standard truck units. Tide Water has 26 semi-trailer units all with 1000-gallon tanks and all drawn by Model AA Ford truck tractors. The drop-frame trailers are Fruehaufs and Trailmobiles.

Tide Water includes in its operating costs an overhaulage reserve which gives it a good operating cost figure for comparison with its standard trucks of the same capacity and in similar service.

"The Ford has demonstrated," Mr. Bertschinger said, "that it can compete equally with heavier units of equal or larger capacity. Its performance suggests that it may be applied to long hauls and further experimentation may develop it to be the means of extending the present boundaries of bulk plants.

This 15-barrel stake job is used by the lubricating oil department of the Standard Oil Co. of Ohio

"A comparison of cost per gallon on various types of equipment places this unit in a favorable position and suggests a possible means of a material reduction in overall delivery costs because of the marked difference in fixed or carrying charges as compared with those for the heavier units."

The Tide Water tanks have four compartments ranging from front to rear 350, 250, 250 and 150 gallons. The faucet for the 350-gallon front compartment is at the side of the trailer. The outlets for the other compartments are at the rear. The front compartment faucet was placed at the side because it provided an easier hook-up with the undercut tank.

The Ford tractor units contain some extra equipment. They have a Winfield carburetor which costs $19 extra, a dual transmission which is $50 extra and dual wheels on the rear axle. When the first of the trucks were put into service it was necessary to equip them with larger than standard radiators, but the larger radiators are now standard equipment, Mr. Bertschinger said.

The Ford tractors, tentatively are being written off in 18 months with an estimated allowance of $150 for trade-in but this period may later be changed. Converting the trucks into service cars for the marketing equipment maintenance department is also being considered. A 10-year depreciation period for the trailers and tanks is being considered.

Pure Oil Co. has one semi-trailer unit engaged in bulk hauling from the Pure Oil refinery at Heath, O., 35 miles to the company's Columbus bulk station. This outfit has a 2411-gallon tank mounted on a drop-frame semi-trailer and a 1762-gallon tank on a four-wheel trailer, a total pay load of 4173 gallons. The unit at first was drawn by a 3½-ton truck tractor but later a 2½-ton tractor was substituted.

This six-ton stake job is in shuttle service of the indus trial lubricating oil department of the Standard Oil Co. of Ohio. When this trailer is being loaded with barrels or cans, the tractor may be off delivering bulk oil from a 2000-gallon semi-trailer tank. Four of these tractors fo rm the power battery for four 200-gallon tanks and seven stake trail ers like this one

Maneuverability is a big feature of semi-trailer jobs. Here is a 750-gallon tank job making a sharp turn at a Standard Oil Co. station in Lakewood, O.

The outfit makes two round trips daily between Heath and Columbus a day, hauling more than 8300 gallons a day, or more than an ordinary tankcar load. The hauling cost has been less than 0.04 cent a gallon as compared with a rail rate of 0.73 a gallon.

The distribution of the weight of the tank, trailer and load over three axles in the semi-trailer jobs permits the hauling of larger loads in most states. However, this advantage is not enjoyed in all states. In New Jersey, for example, a state law prohibits the use of more than one trailer except in the hauling of garbage so oil companies resort to 7½-ton trucks with large tanks and four or six-wheel trailers with tanks.

The Standard Oil Co. of New Jersey recently put in service a truck unit with 2800 gallon tanks to which was coupled a trailer with 2300 gallons tank, a total load of 5100 gallons. This job is in bulk station supply work and covers a large territory radiating from the company's refineries.

Trucking Unit Saves $15,000 a Year in Freight

PONCA CITY, Okla.

A GASOLINE trucking unit placed in service by the motor transport division of the Continental Oil Co. for the Ponca City retail sales division will effect a net savings to the company of $15,000 to $20,000 the first year, in addition to giving the company one of the best possible highway advertising mediums.

The savings will be in freight. The cost and operating expenses of the unit will amount to about the cost of tank cars, or rentals and maintenance of tank cars. What little difference there will be between the cost and operating expenses of the trucking unit and the tank car operating costs will be more than offset by the advertising value.

The unit consists of a Mack truck and two trailers. The capacity of the truck tank and trailer tanks is 6500 gallons. The original unit consisted of a Mack truck of standard design and only one trailer. It was found, however, that the unit was so efficient in operation that a second trailer was added.

The motor transport division recently placed an order for a truck chassis with a more powerful motor. The tank on the present truck will be placed on the new chassis. The unit is used for distributing gasoline to the company's bulk stations at towns on the highways within 50 miles of the company's refinery at Ponca City. The unit is never driven off the highway, and for that reason the maintenance on both the body and the tires is kept at a minimum.

The truck is equipped with Westinghouse air brakes, and even when running at its normal speed of 22 to 25 miles an hour can be stopped within a very few feet. The trailers are so equipped that they track exceptionally well. The fact that they can be coupled from either end also adds to the ease of operation.

Each trailer has dual wheels while the truck chassis has dual wheels on the rear. This gives the unit 22 pneumatic tires. The first unit was equipped with solid rubber tires, but it was found more economical to use the pneumatics.

A rotary pump discharges the load. The pump will put the gasoline either in the top or the bottom of a storage tank at the rate of 90 to 100 gallons a minute, which means the entire load can be dumped in a little more than an hour. No service station dumps are made.

One driver has been operating the unit since it was placed in service, but the transport division has been considering the advisability of speeding up the work by having a relief driver. The unit makes two trips a

day, usually one short and one long haul.

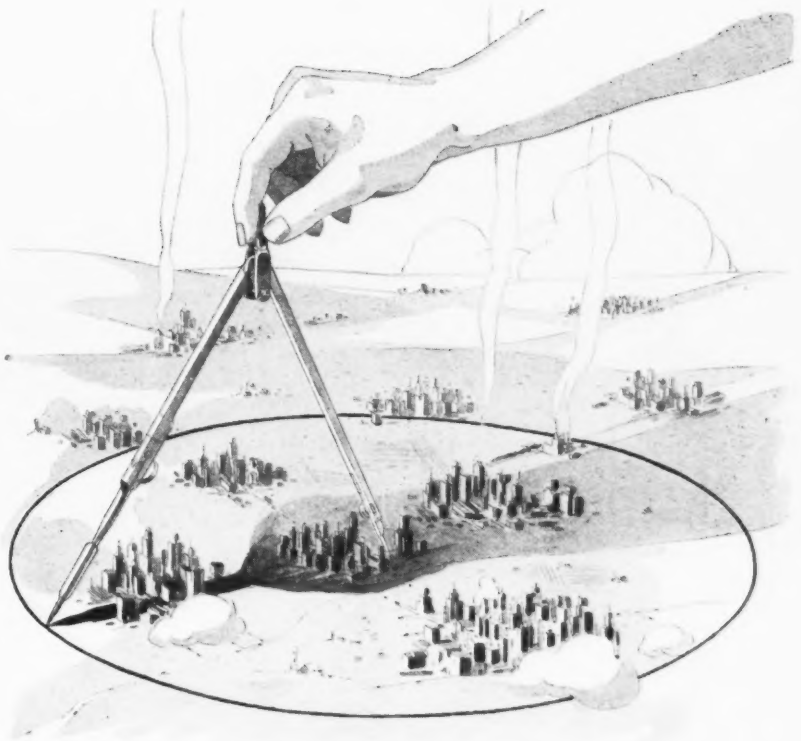
The hose and connections for discharging the gasoline are located in the small spaces on each side of the truck and trailers.

Along each side of the truck and trailers are concealed lights which reflect against the sides of the tanks. At the rear are two small illuminated trade-mark signs—triangle with the word "Conoco." Across the top of the rear tank is a string of red globes spelling the word "Conoco," and in the center of the rear tank is a larger illuminated trade-mark, similar to the illuminated signs on the rear of buses or fast trains. The lighting arrangement makes the truck and trailers attract attention when operated at night.

The storage battery for the truck was not sufficiently strong to handle the lights so a storage battery was installed on each trailer.

The unit is shown in an accompanying picture. The building in the background is the Continental Oil Co. general office building at Ponca City.

R. D. Garnett, widely known in the marketing branch of the industry, is New Orleans division manager of tank car sales for the Shell Petroleum Corp. Through a recent consolidation of the New Orleans Refining Co. with the Shell Petroleum Corp., all interests of the Royal Dutch-Shell group in America were brought under the wing of the Shell Union holding organization. Before that, the New Orleans Refining Co. was a subsidiary of an European arm of the Shell group



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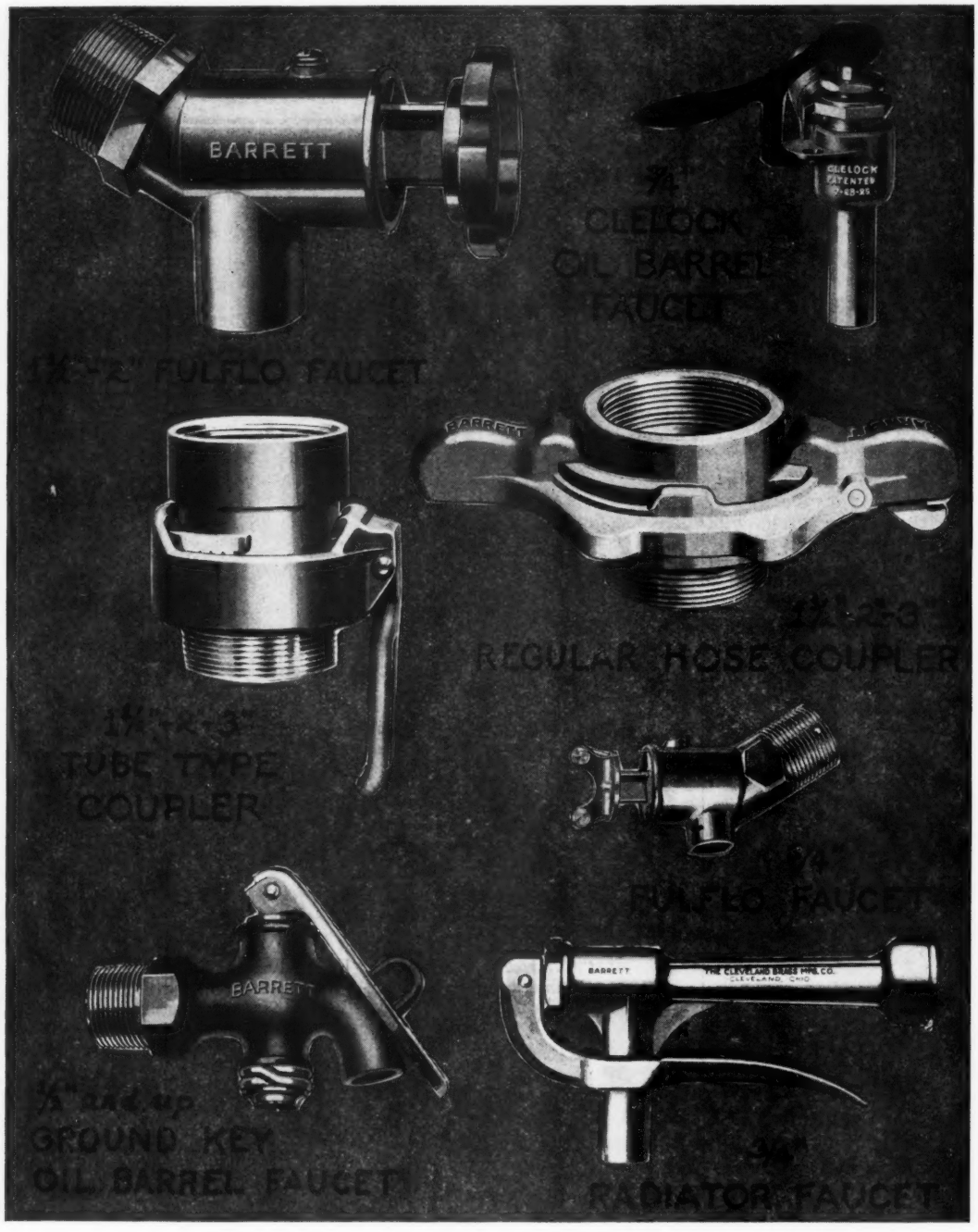

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PRODUCTS

In Selling, Testing, Building Good Will Marketers Find Use for Planes

By N. M. Mainpa
N. P. N. STAFF WRITER

CLEVELAND

ABOUT the time Charles Lindbergh was wearing his first pair of long pants—back in 1914 to be exact—NATIONAL PETROLEUM NEWS made this exclusive prediction in its news columns, on the subject of aviation and the future oil market it might develop:

"Touring, and even commuting, aeroplanes are not at all improbable.

"As evidence of the commercial uses to which the aeroplane will be put is the fact that the United States postmaster has asked for an appropriation for carrying mail by aeroplane in places where, because of poor transportation facilities, days or even weeks are necessary now, while an aeroplane could cover such territory in an hour or two.

"The time will be forthcoming and before many years, too, when the market created by the aeroplane will reach the point where it will pay the oil dealer to devote considerable effort to producing a grade of gasoline especially suited for this work."

That 15 years later considerable effort *is* being spent, not only in producing, but also in selling especially made aviation products, is best illustrated by the fact that 12 oil companies sent 35 aviation salesmen in 15 company-owned airplanes to the 1929 National Air Races and Aeronautical Exposition held in Cleveland in August. These same companies spent thousands of dollars for display booths, for boxes at the air field grandstand and for the gasoline and oils they furnished to contesting planes in the races.

Outside of the value of airplanes as time-savers in business, and in reaching places accessible only with difficulty by other means of transportation, is their value in actual sales work. How much airplanes are being used in selling gasoline and oils is told here by the heads of the aviation departments of the various oil marketing companies operating planes.

While most oil companies agree that they hope to promote air-mindedness among the public in their territory, some of them do not believe in using planes, for the time being at least, in actual sales work at the airport. Notable among these is the Standard Oil Co. of Ohio, which considers that "it would be much better to use it (the plane) for publicity purposes to create good will, and in the end, to help the general sales policy of the company," according to A. M. Maxwell, vice president and director of sales.

The Standard Oil Development Co., subsidiary of the Standard of New Jersey, believes in using its planes in sales contacts at airports, in selling aviation products to airplane operators and manufacturers, for quick transportation of officials, for testing aircraft fuels and oils, and in the performance of other company duties where saving of time is essential.

The Standard Oil Co. of Indiana is of the same opinion, using its planes extensively in selling. It also uses them a great deal for demonstration flights.

The Standard Oil Co. of California, The Texas Co., the Texas-Pacific Coal & Oil Co., and the Associated Oil Co. all use their planes chiefly for sales work.

The Anglo-American Oil Co., Ltd., London, England, has found its first plane so vital in selling aviation fuels that it recently purchased a second. Both will be used in actual sales work and in getting quickly to points not conveniently located on railways.

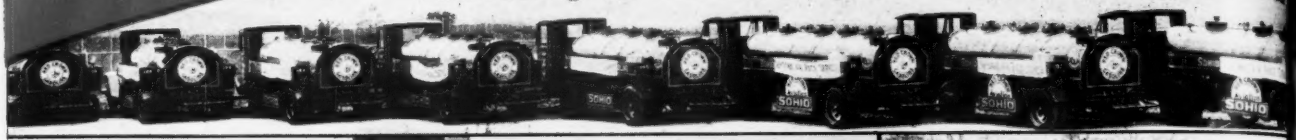
A pioneer in the use of airplanes for industrial purposes is the Standard of Indiana, which bought the first plane to be sold by the Ford interests to a commercial company. It was the sixth tri-motored plane built by Ford.

Allan Jackson, vice president in charge of sales and aviation matters of the Indiana Standard, says that his company furnished large quantities of gasoline and lubricating oils to the government during the world war for aviation purposes; that it began canvassing for an airplane in 1925 and put in an order for a Stout all-metal monoplane, but through a series of delays, such as the taking over of the Stout Metal Airplane Co. by the Ford Motor Co., a fire which destroyed the factory and the Standard's almost completed plane, the rebuilding of the factory and change in models from a single engine Liberty to a Wright Whirlwind tri-motor, the com-

Considered one of the fastest single-motored commercial airplanes in the country, this Boeing biplane of the Standard of California is used extensively by its aviation salesmen in selling aviation products. There are cockpits for two pilots, a telephone system, a cabin for two passengers, and equipment for night flying and landing

FRUEHAUF

Part of huge SOHIO Fruehauf fleet.



Cities Service Oil Company

Gulf Refining Company

Petroleum Heat & Power Company

Standard Oil Company of New Jersey

Humble Oil & Refining Company

Wayco Oil Corporation

Atlantic Refining Company

Roxana Petroleum Corporation

Standard Oil Company of Ohio

Pennsoil Company

Refiners Oil Company

Tide Water Oil Sales Corporation

Sherwood Brothers, Incorporated

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But—did you ever think of the mileage there is in a Fruehauf Trailer? You can confidently expect 200,000 miles or more from every Fruehauf Trailer. That means more real savings.

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Fruehaufs have definitely demonstrated their worth—not in a few isolated cases—but in the service of many of the most successful concerns in the Oil industry.

*Names on request.

Fruehauf Trailer Company

10962 Harper Avenue Detroit, Michigan, U. S. A.

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Two planes of the Texas Pacific Coal & Oil Co. used in sales work—A Ryan B-1 and Stinson Detroiter monoplane. Dealers are often carried as guests for short flights

pany did not receive delivery of its first "Stanolind" plane until May, 1927.

"It was on that eventful May 21, 1927," Mr. Jackson continued, "that the Stanolind made its maiden flight from Dearborn, Mich., to Chicago, carrying several of our directors and officers, together with Mr. Mayo and Mr. Stout of the Ford Motor Co. Such a large group of big business executives had never before flown together in one plane.

"It was remarkable that the Stanolind arrived in Chicago on the same day and within a few hours of the time that Lindbergh landed in Paris.

"The Stanolind was purchased to transport our directors quickly and safely to the distant points to which they must journey on business and inspection trips. It also was for the purpose of encouraging aviation by actually demonstrating to the general public the safety, speed and utility of airplanes.

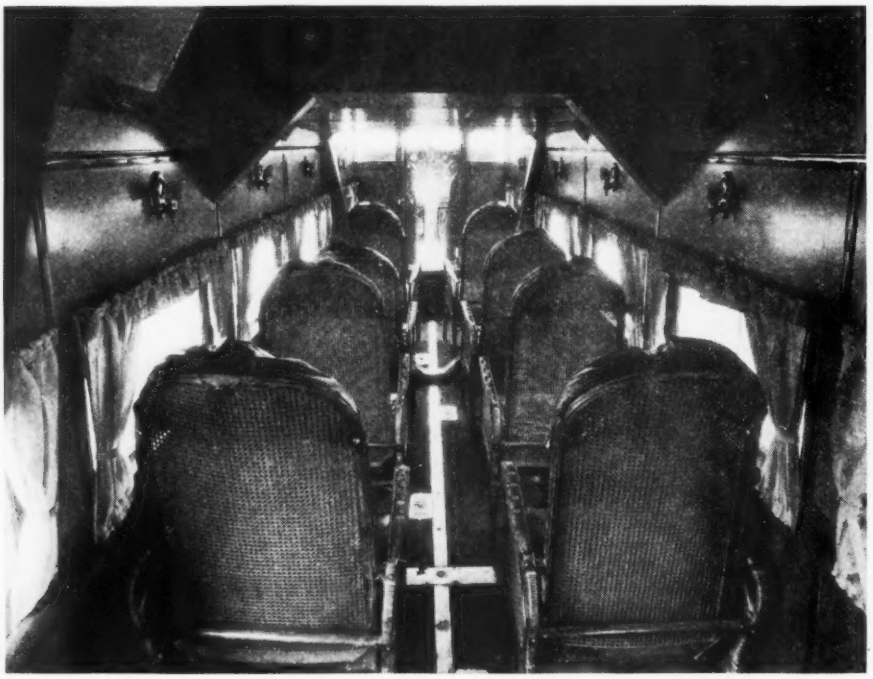
"Our promotional program was to send the plane to various towns and cities in the 10 states where we have marketing facilities, comprising the middle west. Upon arrival it was on exhibition to the general public at least a half day and after that we took up on demonstration flights the mayor, city council, aviation committees, civic leaders and prominent business men whom we felt would become so enthused and airminded that they would devote their prestige, effort and ability to the carrying on of our theory.

"As a result, many new air lines have been formed, and much money invested by people who first rode in the Stanolind. Many good airports have been established due to the desire of cities to have the Stanolind visit them, and our position that we would not land or take off from a field which was not of more than ordinary size and in good condition.

"From May 21, 1927 until we sold it in January, 1929, it flew 966 hours, 48 minutes, traveled 81,404 miles, and carried without revenue 6,166 passengers.

"Our directors flew an aggregate of 87,436 miles in this ship and made many business trips at a great saving of time and fatigue, which is quite an item to us.

"They made such trips as from Chicago to Denver in 11 hours, 35 minutes; Chicago to Casper, Wyo. via St. Louis, Kansas City and North Platte, Neb., in 12 hours, 20 minutes; Casper to Chicago direct in 9 hours, 50 minutes; and an inspection trip to the West Texas oil fields, covering 2,900 miles, in 33 flying hours, over a 4½-day period, getting a much more comprehensive picture of the situation than could have been gotten had they made the trip by any other mode of transportation."



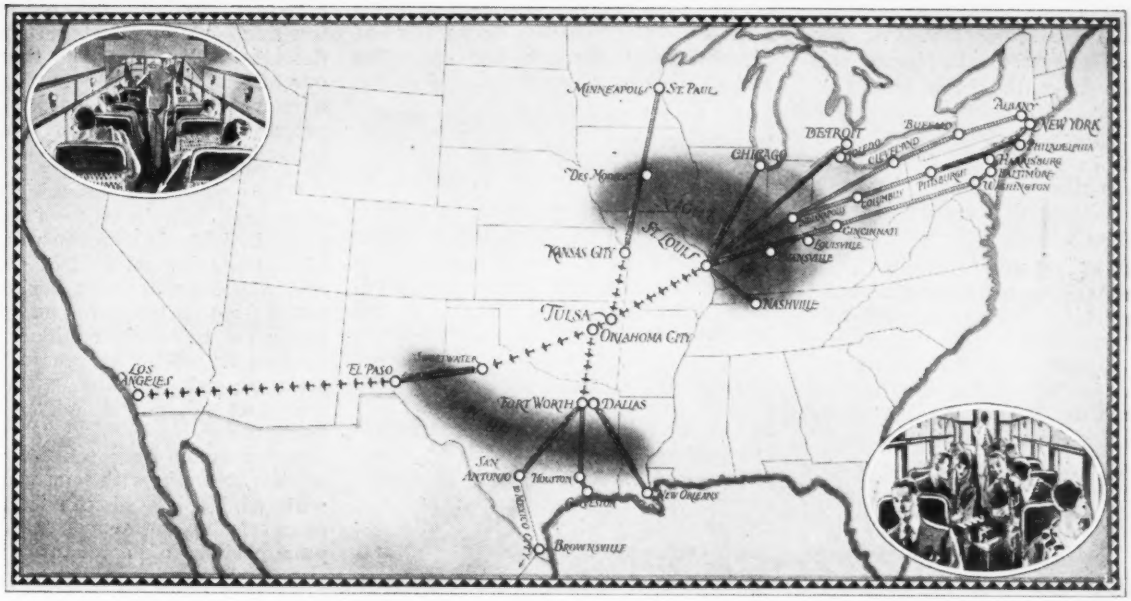
Interior view of Stanolind III, a Ford tri-motor, Wasp engined plane used by the Standard Oil Co. of Indiana to transport its directors and officials quickly from place to place, and in demonstration flights

On one trip Mr. Jackson left Chicago in the Stanolind plane at about the same time several other directors left for New York on the Twentieth Century limited. He flew to Detroit and spent one and a half hours in a business conference, got back into the plane and flew to Toledo, O., waited 20 minutes for the Twentieth Century, boarded it, proceeding to New York with his associates.

The company was so well pleased with its first Stanolind plane, that it now has Stanolind III, also a Ford tri-motor, powered with three Pratt & Whitney Wasp engines, developing a total of 1260 horsepower. The Stanolind II was wrecked in June this year during a hurricane in Kansas.

The company also operates a Laird, three-place commercial biplane, called the Stanolind Junior, which the manager of the aviation sales department uses in covering the company's marketing territory and in supervising sales.

That the oil company operating its own plane is an inspiration for wider use of air transportation is the opinion of Major E. E. Aldrin, manager



Take The S. A. F. E. *Fair Weather Route* Through The Southwest . . . .

SINCE March Southwest Air Fast Express has maintained daily, on-time service over thousands of miles of air routes in the Southwest. Steadily S.A.F.E. has built up a lasting reputation for dependability and safety.

This record is partly possible because of the nature of the country over which S.A.F.E. planes fly. Summer and winter it is the most pleasant, most practical route for the air traveler to follow across the southwest or across the continent.

Transportation is furnished between city and airport. All transports are tri-motored, all-metal Fords, driven by three Wasp engines which develop 1275 horsepower. Each plane is manned by two pilots. Air lanes are charted daily by our own weather bureau, operations are under government regulation.

Itineraries arranged, assistance given in checking trunks by our traffic department. The fare is 10 cents a mile. Write or wire for reservations to—

ST. LOUIS—1161 *Syndicate Trust Bldg., Phone Central 2426*
KANSAS CITY—1103 *Baltimore Ave., Phone Harrison 2550*
TULSA—*Tulsa Trust Bldg., Phone 4-8478*
OKLAHOMA CITY—*Opposite Municipal Airport, Phone 2-5766*
FORT WORTH—*Meacham Field, Texas Hotel Lobby*
DALLAS—708 *Dallas National Bank Bldg., Phone 7-4361*
WICHITA FALLS—*Holt Hotel Lobby*
SWEETWATER—*Blue Bonnet Hotel*
CHICAGO—21 *Palmer House Arcade*
CINCINNATI—*Cosmopolitan Tours Co.*
HOUSTON—*Rice Hotel*

DAILY TIME TABLE

ST. LOUIS—SPRINGFIELD—TULSA

Read Down			*Read Up*
8:30 A.M.	Lv.	St. Louis Ar.	4:00 P.M
10:35 A.M.	Lv.	Springfield Lv.	2:15 P.M.
12:25 P.M.	Ar.	Tulsa Lv.	12:30 P.M.

KANSAS CITY—COFFEYVILLE—TULSA

9:30 A.M.	Lv.	Kansas City Ar.	2:55 P.M.
11:20 A.M.	Lv.	Coffeyville Lv.	1:10 P.M.
12:05 P.M.	Ar.	Tulsa Lv.	12:35 P.M.

TULSA—OKLA. CITY—WICHITA FALLS—SWEETWATER

12:50 P.M.	8:00A.M. 4:30P.M.	Lv. . . Tulsa . . Ar.	8:00A.M. 5:30P.M.	12:20 P.M.
1:55 P.M.	9:00A.M. 5:30P.M.	Ar. Okla. City Lv.	9:00A.M. 4:30P.M.	11:15 A.M.
2:05 P.M.	Lv.	Okla. City Ar.		11:10 A.M.
3:20 P.M.	Lv.	Wichita Falls Lv.		10:05 A.M.
4:50 P.M.	Ar.	Sweetwater Lv.		8:30 A.M.

TEXAS & PACIFIC RAILWAY

8:10 P.M.	Lv.	Sweetwater (CT) Ar.	8:00 A.M.
8:00 A.M.	Ar.	El Paso (MT) Lv.	8:15 P.M.

STANDARD AIRLINES

9:45 A.M.	Lv.	El Paso (MT) Ar.	5:30 P.M.
4:40 P.M.	Ar.	Los Angeles (PT) Lv.	9:00 A.M.

TULSA—OKLA. CITY—FORT WORTH—DALLAS

12:50 P.M.	Lv.	Tulsa Ar.	12:20 P.M.
2:05 P.M.	Lv.	Okla. City Lv.	11:15 A.M.
3:20 P.M.	Lv.	Wichita Falls Lv.	10:05 A.M.
4:35 P.M.	Lv.	Fort Worth Lv.	8:40 A.M.
5:00 P.M.	Ar.	Dallas Lv.	8:15 A.M.

SOUTHWEST AIR FAST EXPRESS

Erle P. Halliburton, Pres.

S.A.F.E. AIR LINES

of the aviation department of the Standard Oil Development Co., New York, which operates six planes. Major Aldrin says that the planes his company operates create a feeling of general fellowship felt by all those connected in aviation and, while not carried on the company's books as such, he believes that feeling is a substantial asset.

Outside of sales contacts with airports, airplane operators, engine builders, aircraft builders, army and navy stations, and prospective consumers of petroleum products for aviation purposes generally, that company uses its planes for these purposes, according to Major Aldrin:

1. Flying laboratory for testing fuel and oil for aeronautical use.

2. Rapid transportation of officials, emergency cases, and despatch of company matters.

3. Attendance at aeronautical exhibitions and promotion generally of airmindedness through the operation and display of aircraft.

4. Aerial photography of company properties.

About the results of operation of its fleet of planes, Major Aldrin says:

"Upon the basis of engine manufacturers' examinations of our engines after their required usage, our products have been approved by the Wright Aeronautical Corp., the Pratt & Whitney Aircraft Co., and the Curtiss Aeroplane & Motor Co.—the three largest producers of aviation engines in the United States. Other airplane companies, upon the basis of these endorsements, have readily accepted our products for publication in their approved lists of fuels and oils for their engines.

"By actual tests in our airplanes, supplementing our laboratory tests, we have procured invaluable data on knock ratings of various fuels, relative merits of so-called natural gas gasolines with gasolines produced from other petroleum fuels; performance of cracked and straight run stocks; the most desirable combustion range, endpoint, volatility, etc., for gasolines.

"This has led to important observations on the frequently encountered 'gas lock' in high temperature operation. Also, data have been gathered on the relative performance of various anti-knock compounds and preparations. Effect of high gum and acid heat in fuels has also been brought into line with safe operations. . . . All these data have been the basis for the development of our present aviation fuels.

"Our studies of lubrication, both of oils and greases, in the fields of the performance of oils with varying viscosities and engine temperatures, penetration, cold weather operation, high temperature operation, consumption, preservation, compounded and unadulterated oils, have determined for us the high quality and economically priced oils we now market under the 'Stanavo' brand.

"With reference to sales contacts, our planes have visited most of the larger airports on the Atlantic Seaboard and in the south as far west as Texas. Our pilots on these occasions have been officials of our aviation department, who are not only qualified to discuss fuel and lubricating problems, but who are also well grounded in airport construction and management. Their advice is not only gladly received but sought after.

"These visits are not made with any idea of high-powered selling. They usually consist of talks with the operators on technical difficulties as well as with marketing organizations. The larger part of sales contact is done by specially selected salesmen, working out of strategically located decentralized offices, and the visits of our official planes are more to assure ourselves and our cusotmers that proper service and quality are at all times being maintained.

"Our policy in selecting aviation personnel has been to attract only those individuals who are well grounded in the practical field of aeronautics and who have a sound background in not only the technique of petroleum products but of mechanical engineering as well. At present the officials of our aviation work are all transport pilots and holders of engineering degrees. It is needless to say that these men approach their aviation work not only with enthusiasm, but with a deep-seated conviction, based upon study and experience, of the practicability of aeronautics in commercial life.

These oil companies are using one or more airplanes in sales work, or other marketing activity:

Associated Oil Co., San Francisco.
Continental Oil Co., Ponca City, Okla.
Empire Companies, Bartlesville, Okla.
General Petroleum Corp., Los Angeles.
Independent Oil & Gas Co., Tulsa.
Kendall Refining Co., Bradford, Pa.
Naturaline Co. of America, Tulsa (Chestnut & Smith).
Richfield Oil Co., Los Angeles.
Rio Grande Oil Co., Los Angeles.
Shaffer Oil & Refining Co., Chicago.
Shell Co. of California, San Francisco.
Shell Petroleum Corp., St. Louis, Mo.
Skelly Oil Co., Tulsa.
Standard Oil Co. of California, San Francisco.
Standard Oil Development Co., New York (Standard of New Jersey).
Standard Oil Co. of Indiana, Chicago.
Standard Oil Co. of Louisiana, New Orleans.
Standard Oil Co. of Ohio, Cleveland.
The Texas Co., New York.
Texas Pacific Coal & Oil Co., Fort Worth.
Union Oil Co. of California, Los Angeles.
Wadhams Oil Co., Milwaukee.
Westland Oil Co., Scobey, Mont.

Here are some of the types of airplanes being used by oil companies:

Standard Oil Development Co., New York:

1 Sikorsky Amphibian, powered with two Wasp engines.

1 Lockheed Vega, powered with one Wasp engine.

1 Hamilton Metalplane, powered with one Wasp engine.

1 Buhl Airsedan, with J-5 Whirlwind engine.

1 Curtiss Robin, with Challenger engine.

1 Keystone Loening Amphibian, one Hornet engine.

Texas Pacific Coal & Oil Co., Fort Worth:

1 Ryan Monoplane, Type B-1, J-5 engine.

1 Stinson Detroiter Monoplane, J-5 engine.

Standard Oil Co. of Indiana, Chicago:

1 Ford tri-motor, with three Wasp engines.

1 Laird, three-place biplane.

Standard Oil Co. of California, San Francisco:

1 Ford monoplane, three Wright Whirlwind J-6 motors, 12-passenger.

1 Boeing biplane, 525 h.p. Hornet engine.

Union Oil Co. of California:

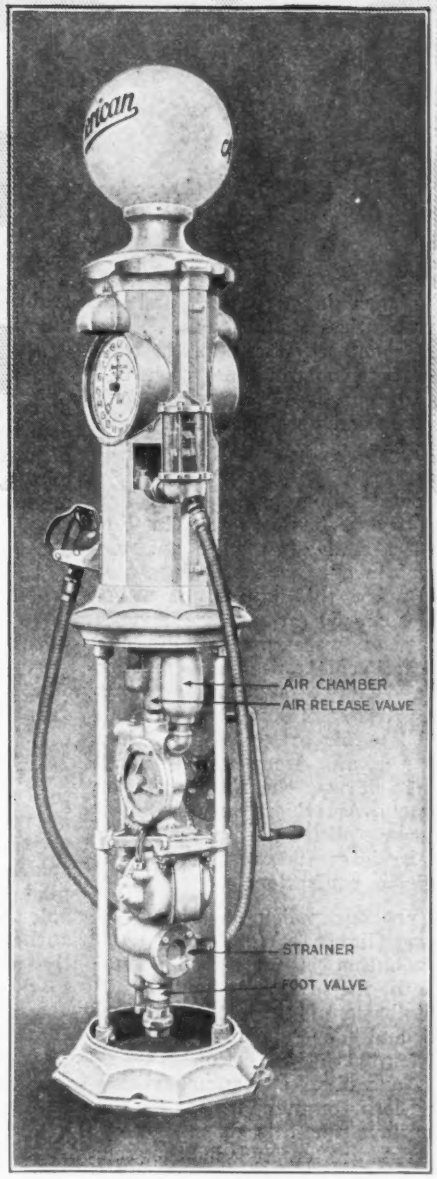
1 Travel Air biplane—Curtiss OX-5.

1 Travel Air biplane—Wright J-5.

1 Travel Air biplane—Wright J-6.

1 Eaglerock biplane—Wright J-5.

WELL FINISHED CORRECT SPECIFICATIONS that insure dependable operation, long life, low upkeep expense



The double-dialed meter with 10" faces makes it easy for motorist to check his purchase from either side. We use the best constructed and most accurate meter to be had. It is the most expensive on the market because it is worth it . . . not to be confused with cheaper meters.

The pumping unit is of the rotary type . . large capacity . . slow speed, only 420 r. p. m., not connected directly with motor.

The motor is standard ⅓ h. p., vapor proof and totally enclosed.

The sight glass is of large capacity, effectually displaying the gasoline being discharged.

And all the other details (check valve, monel metal screen, air chamber, etc.) are there . . some highly important, others not so important, but each necessary and playing its part toward giving you a truly super-pump. All electric wiring is arranged in solid conduit with vapor-proof boxes . . entire outfit is VAPOR-PROOF. Not to be overlooked is the easy accessibility of parts and the sturdy cabinet construction featured by strong uprights.

With the American Presto-Servus Meter System you have a pump, a real pump, a business-builder . . . a 1929 up-to-the-minute model that sets the pace for all meter systems, bar none.

Write for new complete Bulletin attractively printed in colors

The AMERICAN OIL PUMP & TANK Co.

1713 DALTON ST. CINCINNATI, O.

Stanolind, Jr., the Laird, three-place commercial biplane operated by the Standard Oil Co. of Indiana in covering its marketing territory and supervising sales

"Our planes have participated in many aeronautical exhibitions. . . . We have never entered our ships in contests as it is not in line with the commercial purposes for which our planes have been purchased. . . . However, we have engaged in good will tours.

"The outstanding achievement has been the flying business trip in Europe of the manager of the aviation department in our Lockheed-Vega airplane. During this trip eight countries and some 50 airports were visited. Contacts were made with our affiliated oil companies and leading aircraft and engine manufacturers. It was the first time for more than half of these airports that they had ever viewed an American airplane. The trip itself was the first one ever made by an American business man as his own pilot in an American ship in the interests of an American commercial organization.

"It is not our policy to offer complimentary flights. We believe that our contribution is more sound and valuable to the aviation industry if that contribution is in the nature of research and development to make flying safer by the perfection of aviation fuels and oils. Of course, from a profit-and-loss standpoint, all the money outlays for this expensive research work are carried in the red, until such time as the aviation industry, too, appreciates by use that our products are in every respect equal to the standard we claim for them.

"In summary, we believe in the practical utility of aviation in our economic life and our policies governing our active participation therein are those which will contribute to perfecting that state."

The Anglo-American Oil Co., Ltd., which has found its planes invaluable in sales work at airports, believes, like the Standard Oil Development Co., that an aviator salesman landing at an airfield is received, as a rule, with a more cordial welcome than a commercial traveler arriving by car or train, due to the very friendly feeling existing between fellow aviators.

"Undoubtedly," says H. Stuart Tegner, manager of the technical sales department of the Anglo-American company, "we have found that the use of aircraft for this particular branch of the sales department attracts salesmen who are keen and enthusiastic in the development of aviation and, hence are better salesmen in this field."

As to cost of operating planes, Mr. Tegner says that a rough estimate indicates that it does not cost much more to run one of the light airplanes than to run an expensive type of car.

"The clearest way in which to describe the actual use of our airplanes," Mr. Tegner continues, "is to say that we consider that it should be regarded on exactly parallel lines to the cars which we use for our salesmen. We employ two trained pilots who are in themselves trained salesmen. Both these men go through a thorough sales training with us on the commercial side before they take to the air.

"The conditions here in England may be somewhat different to those met with in the United States. Because this country is so interlaced with railways and the service is excellent, that an airplane has a hard job to compete with this form of transportation.

"It is, however, the convenience of the thing which appeals to us, as well as the fact that we can get to centers which are not so conveniently situated to railways at short notice. Urgent calls are where we really score.

"To take a concrete example, the other day one of our technical experts was paying a visit to one of the larger aircraft manufacturing concerns in the west of England. We had a call through from another concern in the east of England asking us to have this gentleman present to attend a certain engine test on the same day. By using our flying machine and sending it down to the west we were able to pick up our expert and take him over to the east in a short time. He was able to keep the two appointments in a day, which would have been impossible without our machine.

"There is hardly a day unless weather conditions are extreme, when one of the machines is not occupied in flying to some part of the country or other. . . . Routine visits are, of course, made to all of the airports and aircraft concerns which have their own flying fields.

"With regard to publicity activities of our machines, we do not do a great deal of this, as we find the machines are too busily occupied on actual sales work. If, however, one of the machines is lying idle, it is quite a customary thing to arrange for one of these machines to fly over any event such as carnivals, fairs, race meetings, motor race meetings, and so on.

"We do not as a rule, make a practice of complimentary flights."

The Standard of Ohio, which does not believe in using its plane in actual saleswork on the air fields, but rather for publicity purposes to create good will and promote airmindedness, believes that all these things will eventually help sales generally. How this company uses its plane is told by A. M. Maxwell, vice president and director of sales:

"We have sent out letters to all of the Chambers of Commerce in the state of Ohio, signed by Mr. Holliday (president). . . . This letter informs the Chambers of Commerce that we have purchased our plane with the idea of fostering goodwill and making the people and communities more airminded, and it also pleads for better and more efficient landing fields.

"This letter was merely a forerunner to acquaint Chambers of Commerce with our policy. On receipt of letters of inquiry from them we have mapped out goodwill tours, the procedure being roughly that the chairmen of the various Chambers of Commerce are asked to call a luncheon meeting, if they so desire, of their local chambers and we will arrange to have our plane in their town with a speaker of interest to tell them of the expansion of aeronautics and airplane activities. . . .

"In the afternoon the plane is at the disposal of prominent persons whom the Chamber of Commerce has asked to ride. These invitations are not extended by any one connected with our company. In other words, we do not wish to create ill will by our people inviting persons to ride with the possibility that those not asked will feel slighted. . . .

"The actual sales of Standard Oil Co. products are never mentioned. The speaker merely mentions that it is through the courtesy of the Standard Oil Co. that the plane is loaned to them, in order to make the people

of Ohio realize the importance of aeronautics. At the time the various persons are taken up, photographs are taken of them and we follow this up by sending them a letter, thanking them for their interest in our plane and in aeronautics, and as a rule, we enclose their photograph.

"We have had a good many letters of appreciation and we feel this procedure not only makes the people more airminded, but creates goodwill and indirectly, increases the sale of our products. We do not allow our division managers, . . . to bring customers or prospective customers to the field for rides, believing this would create ill feeling among those not invited.

"From time to time, when urgency makes it necessary, the officials of our company use the plane for rapid transportation, but this is of secondary importance. Our whole aim is to serve in the aid of aeronautics and secure publicity for the company with respect to our interest in aviation."

Another oil company using a plane extensively for selling is the Texas Pacific Coal & Oil Co., Fort Worth. F. D. Bostaph, salesmanager, says:

"An airplane to a concern selling airports is most important. The distance from one to another and their distance from most towns, gives the airplane distinct advantage over any other means of transportation in making this type of call. The use of a plane, traveling as ours has without accident or trouble of any sort, certainly tends to promote air-mindedness in the public.

"The airplane has taken its place in the oil business not only from the standpoint of sales work but from various other angles. Most of the oil fields are most inaccessible by rail and so located it takes considerable time to get to them by automobile. By airplanes, these fields become accessible and a flight of inspection over them by the field managers gives them a broader and more detailed picture than is possible in any other way.

"About two years ago the Texas Pacific Coal & Oil Co., after careful consideration of the needs of the aviation industry for a special lubricating oil, developed an all-weather airplane oil. This product has been placed in national distribution and, in order to promote and stimulate commercial aviation in a practical manner, a Ryan type B-1, J-5 engine, was purchased and has been used by the sales department in sales work.

"Over 450 passenger guests, mostly dealers and their employes in various parts of the country, have been carried on short flights. In addition to this, there have been several long cross-country trips.

"This Ryan monoplane was purchased approximately 15 months ago, (about April, 1928) and has traveled during that period over 60,000 miles, visiting all but seven of the states. A salesman accompanied the pilot in the plane on all the trips, and, included repeat calls, has made stops in over 300 cities where it was used in actual sales work.

"In addition to sales work, the plane has been used in the promotion of commercial aviation through participation in various events. Some of these, as follows: April, 1928, first all-American aircraft show, Detroit; June-July, 1928, national air tour; September, 1928, national air races, Los Angeles; November, 1928, West Texas Aerocade; December, 1928, International Aeronautical Exposition, Chicago; January, 1929, Miami air meet: February, New York Aeronautical Show; April, second all-American Aircraft Show, Detroit; and June, Dedication of Rickenbacker field, Sioux City, Ia.

"The plane has also been used by the company's geological department in making surveys of the Texas oil fields."

Another oil company whose aviation salesmen have experienced the more cordial welcome extended to them at airports when they arrive in planes rather than by automobile, is the Associated Oil Co., San Francisco, which says that this fact makes unnecessary the breaking down of sales resistance which is usually met when an oil company representative visits a field by auto.

E. B. Bronte, manager of the aviation department for the Associated company, says:

"We have developed infinite good will among pilots at fields visited by taking them on flights and giving them an opportunity to try the controls of the plane, which is equipped with dual control, while in the air.

"We have visited every airport on the Pacific coast large enough for us to land in. Roughly, I would say that these number in excess of 150 fields.

"We have transported officials over our territory, which consists of Washington, Idaho, Montana, Oregon, California, Utah, Arizona and Nevada, and have secured many accounts for our company, other than aviation accounts, by carrying on short flights purchasing agents and other officials.

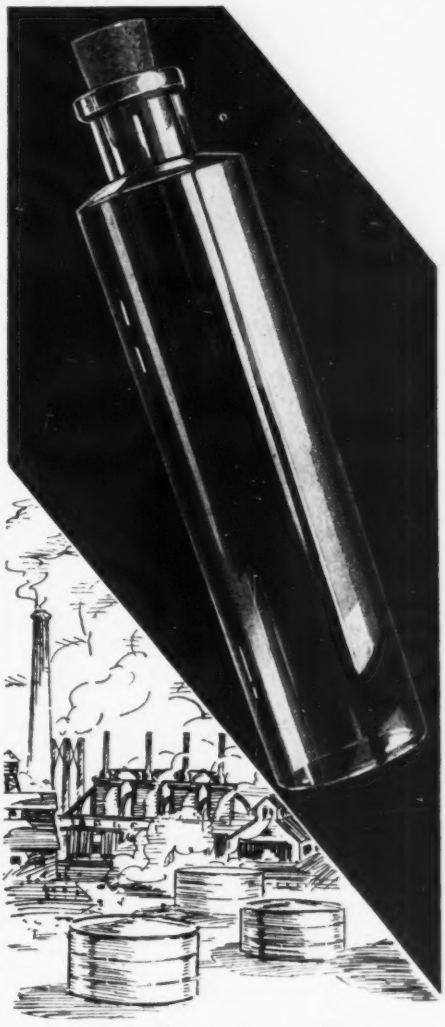
"At the most we can only carry three passengers on each flight, two in the cabin and one in the forward open cockpit, but we figure that in the 600 hours that we have flown our plane, we have carried in excess of 1000 passengers.

"At the same time we have tested our new aircraft oils and fuels for long periods in the air with our plane.

"Then there is also an important item of publicity which our plane secures during its progress through the territory, particularly in the smaller communities. We feel that the results obtained through its operation have been extremely beneficial and satisfactory."

An effort to identify itself with the

Oil Samples make Sales



~in these clear, brilliant bottles

Your product is your best salesman, so make sure that it is dressed in the best possible way. Owens-Illinois sample oil bottles are hand-blown of the finest perfume-bottle glass to give the maximum in beauty and display.

Special attention is given to the necks of these beautiful bottles. They permit of perfect and uniform corkage.

For a slight extra charge you may have your trade-mark blown on each bottle. Obtainable in 2, 4 or 8 oz. sizes. Samples gladly sent upon request. Owens-Illinois Glass Company, Toledo, Ohio.

OWENS·ILLINOIS
BOTTLES

practical advancement of aeronautics has led the Standard Oil Co. of California to purchase two planes, one of which is used chiefly for promoting airmindedness and to demonstrate the safety of present-day aircraft, and the other by aeronautical salesmen who visit airports and airplane operators to prove to them the satisfactory quality of the company's products as demonstrated by their own use of them in the company planes.

"The company has a direct contact with all flying fields of the western United States," says S. S. Chadderton, manager of the aviation division of the sales department of the Standard of California, "and can know first hand all activities and requirements of the aeronautical industry it seeks to serve.

"Both planes at various times participate in the dedication of airports, exhibits and demonstrations of all kinds. We are constantly deluged with requests for either or both planes to be present at these functions and we try to fill as many of these requests as possible.

"To date we have taken up approximately 9500 gratis passengers on short flights, most of these people having never been off the ground before. We have covered a distance of approximately 80,000 miles and visited practically every established airport on the Pacific coast, as well as having made several transcontinental trips. The passengers picked for these trips are chosen from prominent citizens, public officials and influential business men who have to do with the promoting of aviation in the vicinity visited.

"The 'Standard of California No. 2,' a Boeing biplane powered with a 525 horsepower Pratt & Whitney Hornet engine, is considered one of the fastest single-motored commercial crafts in the country and probably the best equipped. There are two pilot's cockpits and an enclosed cabin with comfortable accommodations for two persons. A telephone system connects all three compartments. The plane is equipped for night flying and landing, and can even descend upon an unlighted field. It has a cruising speed of 110 to 115 miles per hour and a high speed of 145 miles per hour."

In addition to this, the company has in aviation's behalf painted on the roofs of its warehouses over 500 signs bearing town names and directional arrows to guide the flyer; has published, for complimentary distribution, several editions of its manual on "Airplane Landing Fields of the Pacific West"; and has erected five 10,000,000 candlepower air beacons for the guidance and safety of flyers at night near San Diego, Los Angeles, San Francisco Bay, Portland and Seattle, which are visible for over 150 miles.

The Union Oil Co. of California is operating four planes at present, according to C. F. Lienesch, manager of its aviation activities. One is assigned to each of the company's sales divisions and the fourth is for use of the manager of technical relations and aviation sales.

"We believe that the most successful way to sell oil products for use in aviation, is to have salesmen who understand the problems involved in flying as well as the ground requirements for airplane motors," said Mr. Lienesch. "Certainly no one is more qualified to know these problems than the pilot. Our pilots also test the quality and reliability of our products in their planes, and from time to time examine the feasibility of developing new products.

"The pilots who are now operating our planes are all very enthusiastic about this method of selling. They have found that they can not only talk from the standpoint of experience, but that the greater frequency of call, faster passage in a contingency, and increased size of territory which the planes make possible, are particularly advantageous.

"Our planes as outlined above are strictly 'work planes.' We do not make it a practice to carry passengers unless absolutely necessary. We have found the cost of operation to be low enough to justify their use.

"These planes are of definite value in other phases of our business, such as geologic survey, emergency transportation of equipment or personnel, etc. A specific example of the profitable use of planes is as follows. At one o'clock in the afternoon of August 4th one of our oil barges, the 'Phelps,' which was then at San Luis Obispo, caught fire and burned for about an hour. This barge was bound for San Francisco, and although the fire was inconsequential, the boat had to be inspected before proceeding, and every hour of delay was costing the company fifty dollars. Our inspector at Los Angeles, Geo. B. MacLean, traveled in one of our planes to the barge and succeeded in getting it on its way again by six o'clock P. M. It was necessary for Mr. MacLean to be in Los Angeles again early the next morning to inspect our tank ship the 'Los Angeles.' This he did easily enough by plane. The use of the airplane saved the Union Oil company $950 in ship's time and cost but $25 more than the cost of the trip by automobile or train.

"It is our policy to aid in the promotion of those constructive aviation activities which we believe are of benefit to the company, and to the cause of commercial aviation in general. In this connection we have attended airport and airplane dedications, and aided several feature flights such as the Southern Cross, and the recent Women's Air Derby.

"Two of our pilots have just returned from Cleveland where they attended the National Air Races. During the past summer an air law course, introduced for the first time into this country, was sponsored by the Union Oil Company. In the interest of aviation our company has built a field on its lease in Vera Cruz, Mexico. A second field has been built at San Luis Obispo, California, on the Union Oil tank farm, to serve as a temporary airport for San Luis Obispo County, until such time as the County Board of Supervisors decide on the purchase of a permanent site.

"In short, the development of aviation as a means of human progress, more efficient transaction of company business through the use of planes, and the production of the finest aeromotor fuels and lubricants for the greatest prospective market of our products, is the three-fold purpose of the company in aeronautics."

The Empire Companies, Bartlesville, Okla., purchased a plane in July and is using it for the time being in experimental, research and development work to further develop its aviation fuels and lube oils, according to E. L. Peck, manager of the aviation division.

Anderson-Prichard Oil Corp., Oklahoma City, Okla., has not used a plane this year although it did have an interest in one during a large part of 1928. It was used for transportation between the company's refineries at Cyril, Okla., Wichita Falls and Colorado, Tex., and also for sales work. It was found to be a great saver of time, according to C. L. Mayhall, director in charge of refined oil sales, and the company has been considering getting one for its own individual use.

Many other oil companies marketing petroleum products are using airplanes in various ways. There are about 30 of these. The total number of oil companies engaged in various branches of the industry using planes is close to 100.

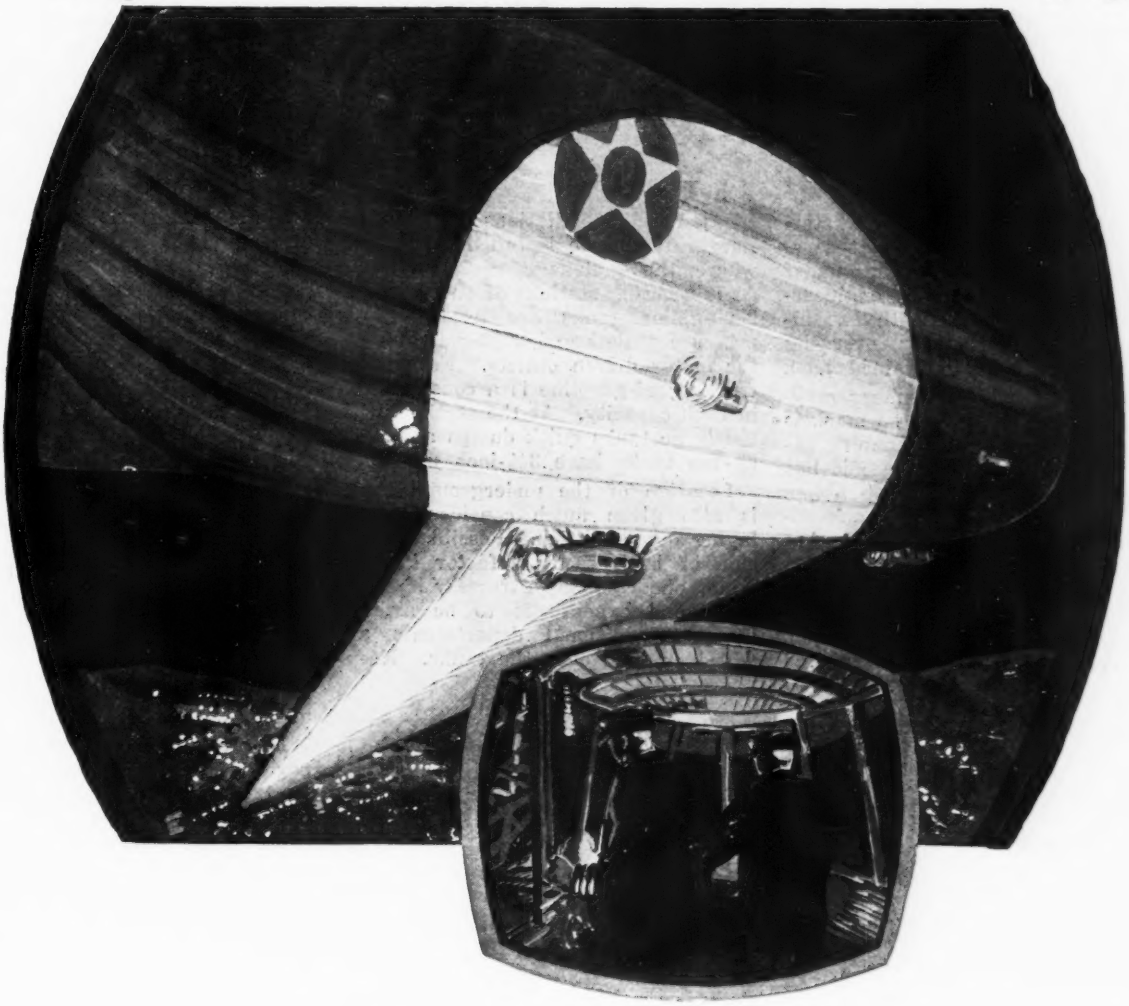
One oil company which did use a plane and later sold it because cost of its operation was not warranted for publicity purposes only is the Waverly Oil Works, Co., Pittsburgh, Thomas J. Hilliard, president, says:

"We bought our plane shortly after Lindbergh's famous flight in an endeavor to capitalize on the interest of the public at that time and sold it a year later, in July, 1928.

"At that time it was a great means of publicity, but interest was lagging in the summer of 1928, and we decided we either had to go into it in a much larger way or get out of it entirely, and the expense of operation, we felt, for publicity purposes only, was a great deal more than was warranted.

"We felt that the public visiting airports was not particularly interested in any one plane but in all planes and especially the larger ones which caused particular interest. We had had no need of a plane for the transportation of our officials or sales department so far."

BE SQUARE TO YOUR MOTOR



To-Day *for to-morrow*

The present high development of aircraft engines, planes and dirigibles has been made possible by hundreds and thousands of tests. Pioneering one design after another, engine after engine, change after change is responsible for the great feats of aviation that day after day startle the world and wake us to the realization of the dawn of a new era of transportation.

To meet this new demand of modern aircraft engines, Barnsdall has developed super AVIATION fuels and lubricants that protect these costly engines of the air and make possible maximum power with economy.

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Engineer Supersedes Plumber Installing Station Tanks

UNDERGROUND gasoline storage tank installations at service stations are coming under the direction of oil company engineering departments in line with our industry's trend of turning over its mechanical problems to trained men.

The day of the local plumber making installations is passing so marketing executives in four companies report. "In 14 years' experience it has not been necessary to take up a line that was laid properly," said one engineering department executive. Another company entrusts its dealer installations to local contractors, but the contractor must qualify with some experience before he is awarded a job.

The 1000-gallon tank was favored for general installations at stations. Larger tanks are installed at stations where the gallonage may be large. At lubricating stations of one company 2000-gallon tanks are used for air pressure outlets and 3000-gallon tanks for motor driven outlets. Economical trucking of gasoline is a consideration in tank capacity. At the stations with the large tanks quick dumps are made as the tanks have 3½-inch fill pipes.

Location of the underground tanks is also given much consideration in laying out a station. Possible expansion of business is a factor kept in mind, one company stressed, if much labor and expense is to be avoided in case additional departments are added on land over the tanks. Keeping the tank truck out of the way of traffic is another consideration. Three of the companies provided offset drives for trucks, while the fourth company allowed the truck to block one drive.

Packing good, clean earth around the tank, after placing the tank on a solid earth or concrete foundation, was advised. Cinders are considered unsatisfactory on account of possibilities of corrosion to the tank.

Burying the tank and lines connecting the outlets to avoid expense or breaking up concrete drives was considered also. Where lines pass under concrete usually they pass through sewer crock. One company burying tanks under the outer drive keeps half the tank under earth and half under concrete.

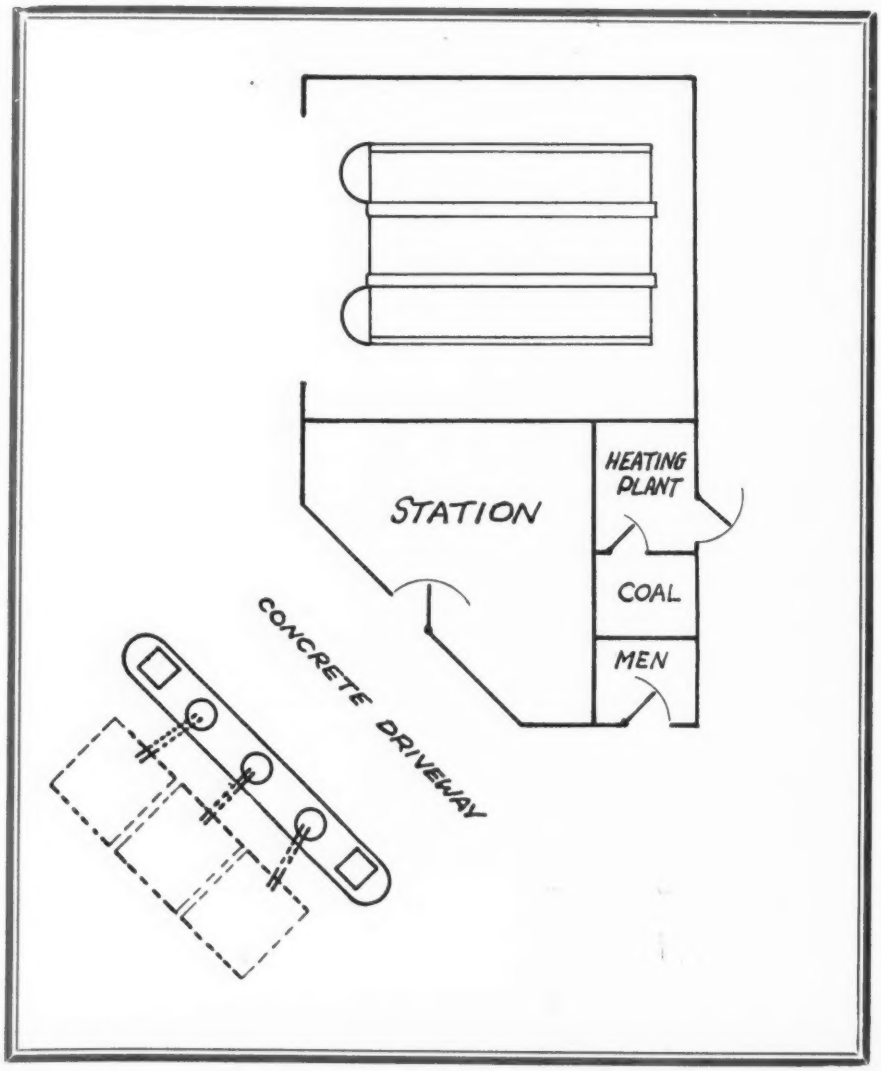
Location of the tank, and its capacity is governed by amount of space on the lot, and tempered by state or local codes. Companies marketing over wide territories reported encountering many codes governing depth of burying and size of tanks. Nearness to other buildings, depth of basements in adjoining structures, and crown of streets are determining factors in some codes on how deep the tank may be in the ground. Codes vary with communities and have to be studied before a station with its installations gets to the blue print stage of development.

Following are detailed accounts of what four companies consider good practice in installing underground gasoline storage tanks and piping to outlets.

An accompanying illustration shows the layout of tanks at the elaborate lubrication station of the Standard Oil Co. of Ohio, at Carnegie and E. 89th st., Cleveland. The drawing of the tanks and station building were taken from a blue print; the lines connecting tanks and outlets show the approximate course.

For air pressure meters, as at the Carnegie ave. station, Standard of Ohio installs two tanks for each grade of gasoline, and for motor driven meters one tank. At this particular station there are two tanks for Ethyl gasoline, and two for Red Crown gasoline.

An important factor at Standard's large lubricating stations in providing storage for a big dump as well as having the dump made quickly. Fill pipes are 3½ inches, and a 2000-gallon truck can dump a load in about



Layout of a White Star Refining Co. station, with tanks partly under the outer drive, so the station could be expanded without disturbing the tanks

15 minutes. The vent pipe is 2 inches.

Standard of Ohio is using slag drives, so lines connecting the tanks and outlets are run through the ground. Where concrete drives are used the line is run through a tunnel.

Minimum capacity of tanks being installed is 1000 gallons. At the lubricating stations meter outlets are used, and tanks sizes are 3000 gallons for motor driven and 2000 for air pressure outlets. These tanks are 3/16 inch thick, covered with an asphalt paint. Unless local codes forbid, tanks are buried in the earth without foundations.

On top of the tank is an angle check valve, with a manhole for easy access to the tank. The state code in Ohio requires the top of the tank to be three feet under the crown of the street.

The tanks at the station illustrated herewith are to one side. Trucks can dump gasoline without blocking traffic. The tanks are so located that tank trucks can enter and leave the station without going on the main drives.

Placing the tank under the outer drive is a favored location with the White Star Refining Co., Detroit. This location is pointed out as having two advantages; first, it will not interfere with expansion of the station building; second, with the tank half under concrete and half under earth access is easy in case it is necessary to dig to the tank.

The locating of the tank in relation to station expansion was stressed by the White Star engineering department. When a station is being laid out the plans allow for the building of an enclosed greasing or other department at some future time if business warrants. Tanks at the side of the building might have to be dug up for this expansion.

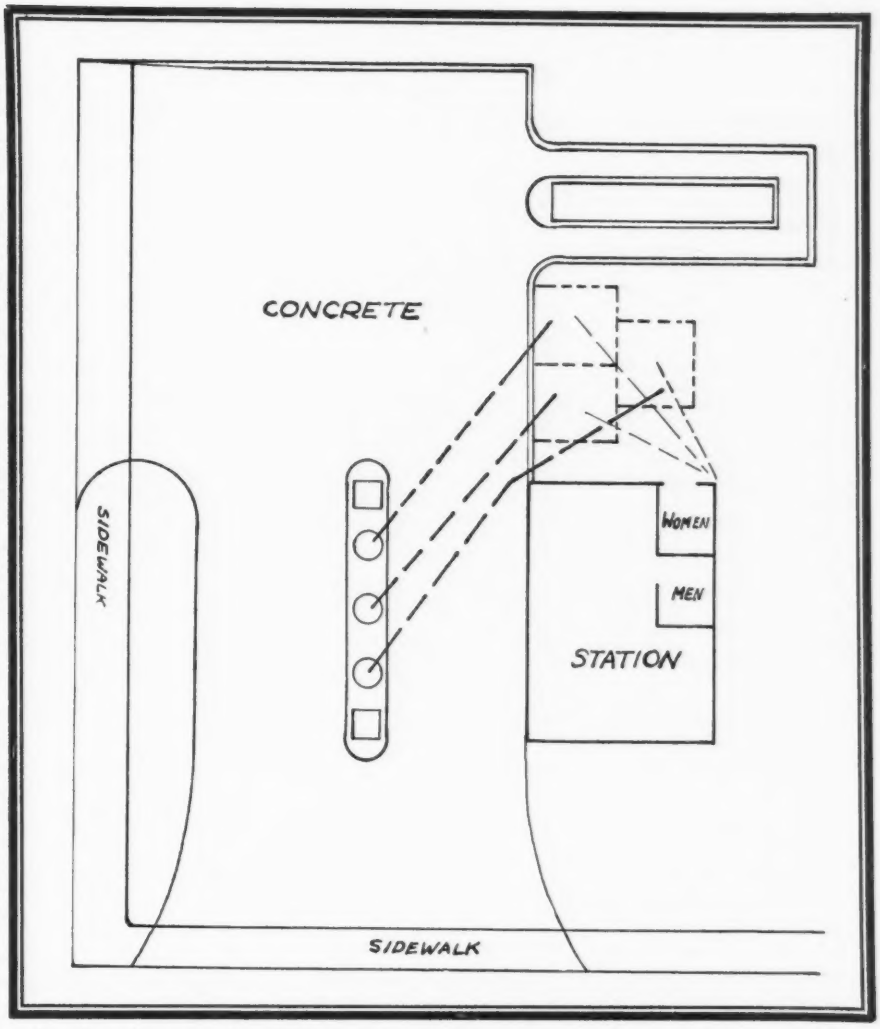
This location also places the tank near the pumps. Less pull is necessary in pumping gasoline from the tank, and there is a saving on the amount of pipe used to connect the tank and pump.

All installations are made by experienced men. At company owned stations the engineering department does the installing. For dealer stations bids are taken from local contractors for this work. The contractor, however, must have made other service station installations before his bid is considered.

The day of the plumber or the jack-of-all-trade mechanic in making installations is gone, the engineering department reported. One instance of grief from a plumber's installation was the hooking up of the suction pipe to the return outlet.

Tanks are filled with the truck standing in the outer drive. This blocks traffic in one lane at the station but is considered a better place for the truck than unloading on the street through an offset fill pipe.

Vents must be 10 feet above the ground and five feet from a building, according to the Michigan state code. White Star usually runs the vent pipe to a curb sign post. The vents and fill pipe are on the earth side of the tank.



Another layout of a White Star Refining Co. station. Tanks are side of station building, necessitating an excavation job if enclosed lubrication department would be added to station

The size of the tank to be installed depends upon the expected gallonage and the size of the hauls of the tank truck. As a general rule White Star installs a 1000-gallon tank for each pump or 1500-gallon tank for two pumps. Three grades of gasoline are marketed through the stations. In some outlying districts 500-gallon tanks are installed.

The tanks are of 3/16-inch steel, covered with an anti-rust paint by the manufacturer.

Bottom of the holes must be absolutely level for an accurate gauging of the contents. Hard packed earth forms most of the beds. Where there is quicksand the bed is blocked with wood, and so are all lines. The top of the tank is three feet in the ground as required by the state code.

For visible pumps 1½-inch galvanized lines are used for the suction line and the return. Blind pumps have a 2-inch line and 1½ and 2-inch lines are used on meters. A double poppet foot valve, or double poppet angle checks, are at the tanks. Where the line goes under the concrete it is carried in an 8-inch sewer crock.

The engineering department stressed the installation of fool proof foot valves to save much time and labor in tearing up concrete.

One of the large mid-west companies uses 1000-gallon tanks at most of its stations. In some of the larger stations 2000-gallon tanks are installed, but the 1000-gallon tank is used more extensively.

The tanks are placed at the side of the station building, as near as possible to the outlet. This closeness to the outlet is an economy in piping as well as a shorter haul in delivering gasoline. Tanks are filled with the truck off the drive out of the way of traffic.

As a rule there is one tank for each outlet. Two-inch lines are used, and under the concrete drives the pipe is housed in a 6-inch sewer crock. The footvalves are at the base of the outlet.

Tanks are placed in the ground without a foundation. Earth is packed

BUILT TO AN ENGINEERING STANDARD

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We invite you to ask us today for complete information regarding the definite and very tangible sales helps that go with GearO—the Improved Gear Lubricant for Enclosed Gears.

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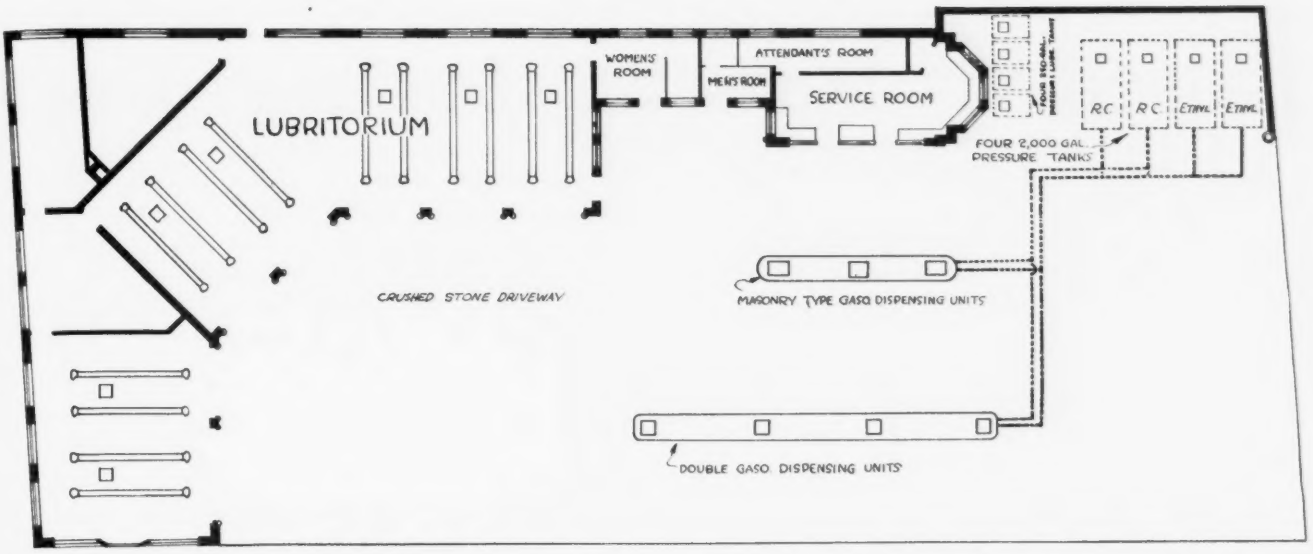


The ground plan of Standard of Ohio's lubricating station at Carnegie and E. 89th street, Cleveland. Tanks are at side so truck can make dumps without blocking traffic

around and on top of the tanks. Cinders are not used on account of corrosion.

Before the tank is lowered in place it is air tested. After the fill in water is pumped into the tank and a gauge taken as a check on the capacity. The tank has a coat of asphalt paint before delivered to the station. The 1000-gallon tanks are 12 gauge. All installations are made by the company's engineering department.

A separate tank for every outlet is the policy adopted by the Pure Oil Co. C. A. Peterson, of the engineering department, who has had many years experience with station installations particularly emphasizes this point.

Where more than one outlet is attached to a tank difficulties may be encountered if additional grades of gasoline are to be marketed, he points out. For instance, if a station has three or four outlets off one tank another installation would be necessary in case a second grade of gasoline were added. If this station had a tank for each outlet the second gasoline grade could be put in without an additional expenditure on tanks.

Proper installation of lines was stressed also by Mr. Peterson. Proper and careful installation of lines in the first place is a good investment, since many of these lines are located under the concrete driveways their removal for repair is usually a very costly procedure.

Where local laws allow Pure Oil Co. puts in a tank with a minimum capacity of 1000 gallons. This size, or larger, is used for economical truck of gasoline. The tanks, 3/16 inch thick, are tested to five pounds air pressure before installation, and are protected with a coat of asphalt paint.

The tanks are placed on concrete slabs 6 inches thick. Around the tanks good, clean dirt is packed. Cinders are not used.

A footvalve extractor is placed above the tank so there is easy access to the valve in case of difficulty. Two-inch lines are laid from the tank to the outlets. As with the tanks, these lines are packed with good, clean earth. The line slopes towards the tank for drainage. All installations are made according to engineering department specifications.

The tanks are located so the truck can make a dump without blocking traffic, the truck standing on an offset from the main drives. The tanks are not placed under concrete drives. Possible future expansion of the station is kept in mind also.

H. R. Kellar of the Cooper Petroleum Co., Houston marketers, spent many years as a lubricant salesman before becoming a member of the present firm, in partnership with B. P. Cooper. Mr. Kellar was formerly with the now defunct Keen & Woolf refining organization and Mr. Cooper with the Sinclair Refining Co.

SYRACUSE, N. Y., Oct. 26.—Poles and floodlights made by C. C. Bradley & Son here for service stations, have been ordered from that company recently by the Standard Oil Co. of Ohio, Cleveland.

Instead of the poles in the light standards being welded together, they are fastened by a new process developed by C. C. Bradley, which process insures a strong, rugged, durable job, according to the company. They are hammered together by the Bradley hammer.

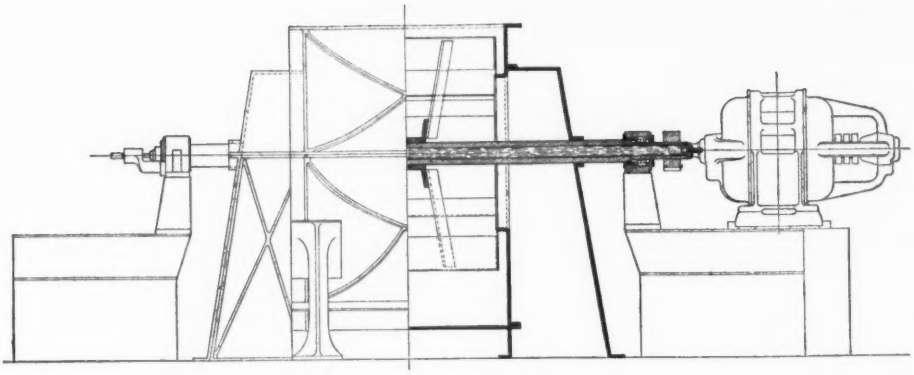
Among other oil companies using this company's floodlights and standards are the Tide Water Oil Co., Colonial Filling Stations, The Texas Co., and Shell Petroleum Corp.

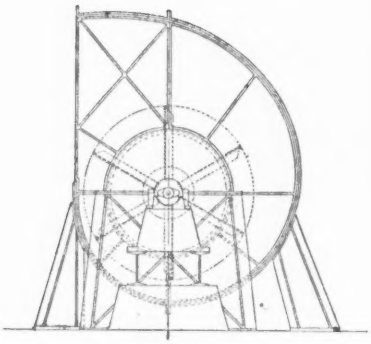
DETROIT—Alfred P. Sloan, Jr., president of General Motors Corp., has announced the resignation of C. C. Cooper from various official positions within the General Motors group of companies. Mr. Cooper's principal position was the presidency of General Motors Acceptance Corp. and the chairmanship of the General Exchange Insurance Corp. Mr. Cooper plans to devote his time to other activities.

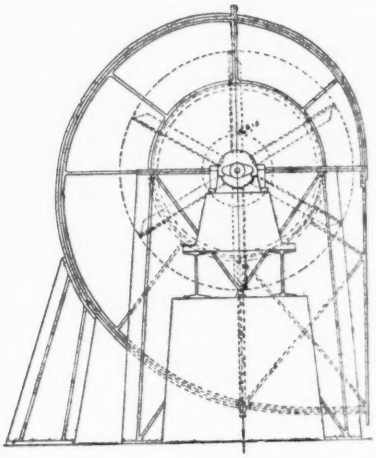
John J. Schumann, Jr., formerly vice president, succeeds Mr. Cooper as president and chairman respectively of the companies mentioned above.

FLINT, Mich.—A C Spark Plug Co. announces the resignation of Basil W. de Guichard, president and general manager, who resigned because of ill health. He has been succeeded by H. H. Curtice, formerly vice president and assistant general manager.

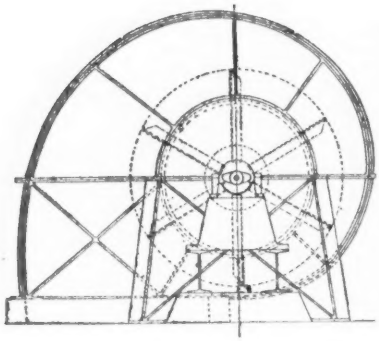
LIENTZ Recirculating Fan

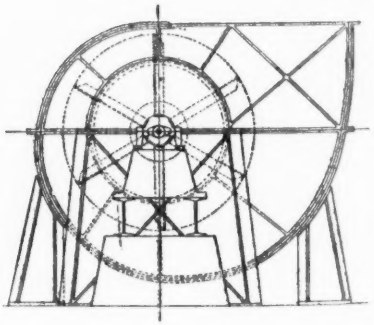






The illustrations hereon show the Lientz Hot Gas Fan which is designed for whatever capacities may be required. The construction is such that advantageous application can be made to any type of Oil Refinery unit. Prompt shipment on all orders.





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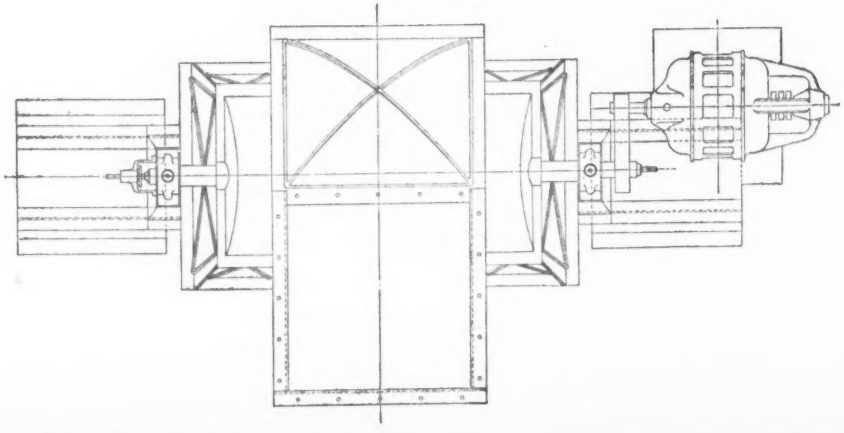
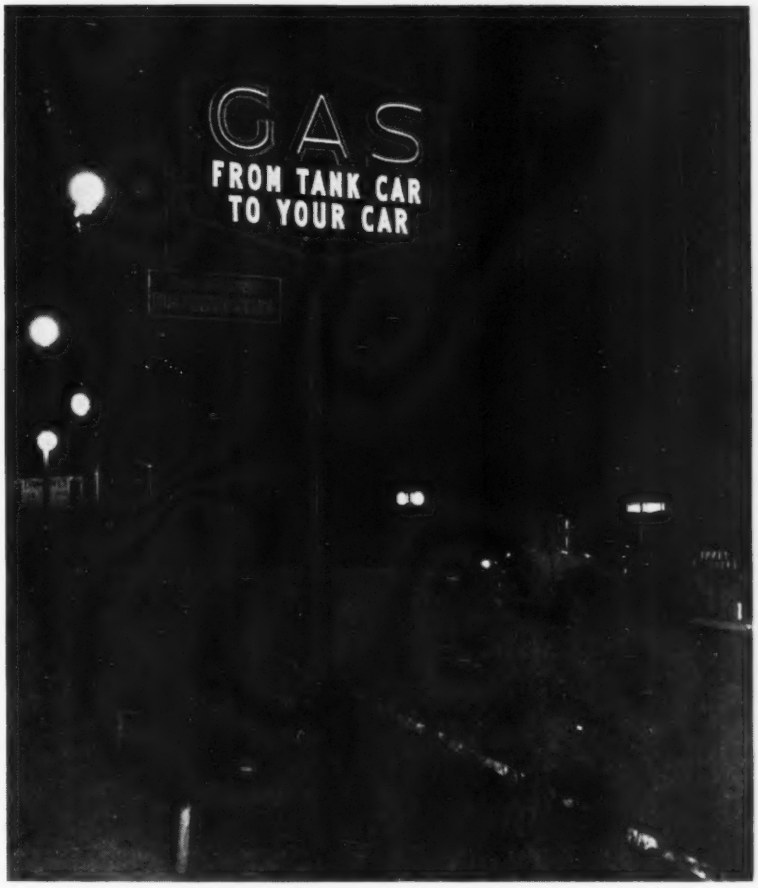


Gas Signs For Gas Stations



A curb sign at a service station with the word "Gas" in neon tubes

By Channing Whitman*

OUT of the night come two lights . . . an automobile is speeding on its way. Will it stop at your station for gas and oil? No!—unless the driver is reminded to check up his fuel supply by being told "Gas is for sale here" by means of an electric sign.

In former days a lighted gas station, without a prominent electric sign, did business because gas stations were few and automobiles went at a comparatively slow rate of speed. So when the driver saw the brightly painted pumps he could turn in.

Today the facts are different. This is an age of speed. Roads are better and cars can and do go faster. When the driver sees merely some bright lights ahead of him on the road he passes them before realizing that gasoline is sold there. It has become absolutely essential for a gas station to feature an electric sign. If it tells what kind of gas is sold, so much the better, because drivers have their pet brands and prefer to purchase them.

The gas station electric sign must be so located and be of sufficient size and brilliance that the driver, yet a distance away, has time to think about checking his fuel supply and to come to a stop at the pump without screaming brakes and skidding tires. Perhaps the brightest electric sign of the present day is made either in part or entirely of neon because this gas, illuminated with electricity, has the power to seize and hold the attention of passing traffic even when fog, storm and smoke are present in the air.

Basic Facts About Neon

When that eminent English scientist, Sir William Ramsay, discovered in 1898 a new gas and named it neon (from the Greek word Neos, meaning new) little did he realize that neon would eventually be used to make thousands of electric signs beautiful and effective.

Pure neon gas tube signs are of a flaming red, made by electrifying the pure gas in a white glass tube. A smaller number are blue, made by mixing neon with other rare gases and a few drops of mercury, and electrifying them in a clear glass tube. Still other neon signs are green tone, made by using neon and other gases with mercury electrified in an amber colored tube.

The red neon is considerably brighter and more penetrating; the blue in its turn is somewhat brighter than the green illumination. The blue neon tube costs about 10 per cent more than red; green about 15 per cent more than red. Other colors have been obtained and used to a slight extent but are not practical in the present state of neon development.

Oddly enough, the smaller the diameter of the tube the brighter the illumination. For this reason the practice has been to use tubes of a small diameter. Letters up to 24 inches high are made of tube a half inch in diameter. For large roof top building front displays a double row of tubes is often used.

The neon gas in a tube conducts electricity just as a copper wire. It is the electricity passing through the resistance of the gas that makes the tube glow. It is a strange fact that when the tubes are lighted they are practically cold. Though a high voltage is used to illuminate neon gas—usually 12 to 15,000 volts—the amperage is very low—usually 25 milliamperes (25-1000 of one ampere).

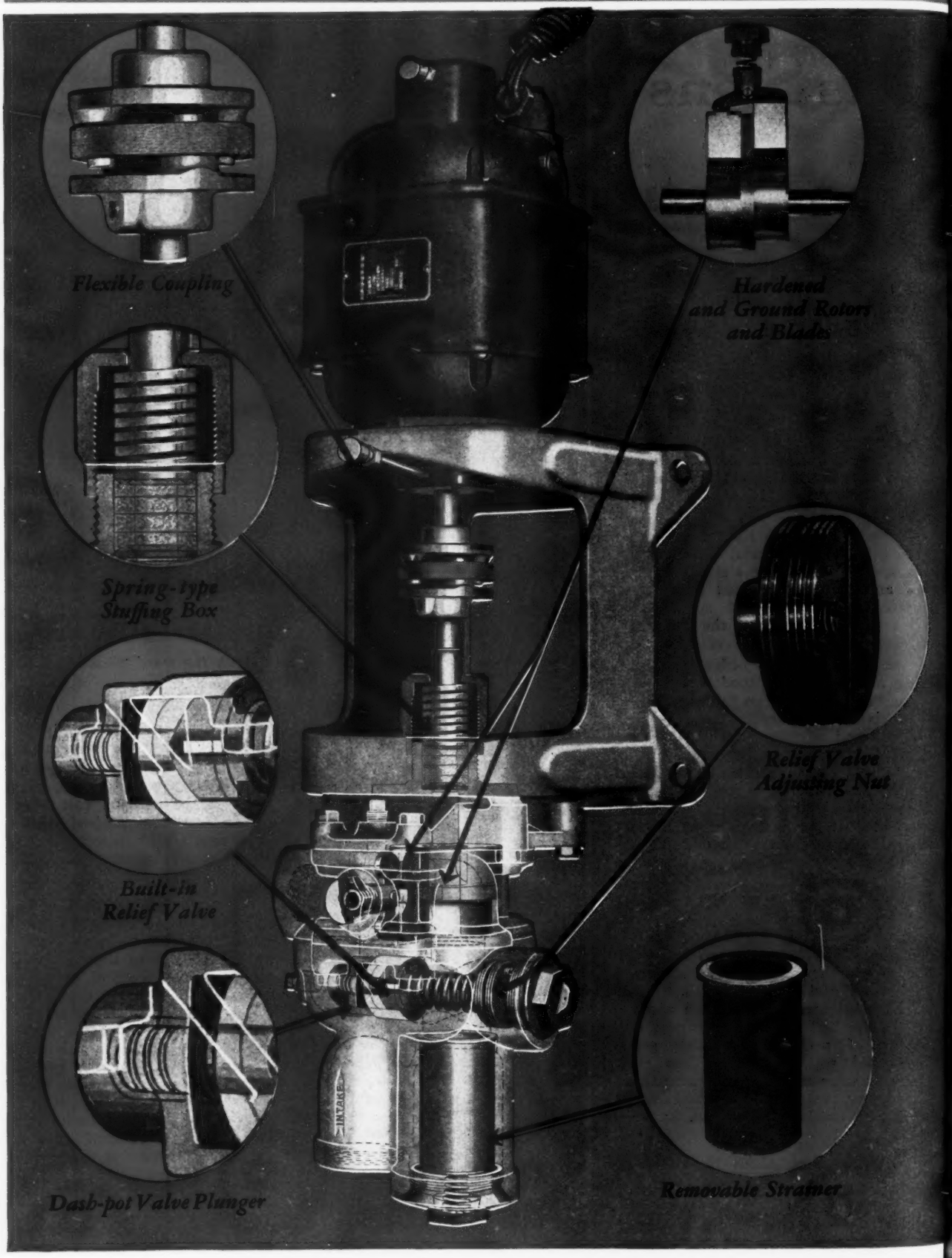
Necessarily each neon sign requires one or more transformers, to change the ordinary 110-115 volt alternating current to the desired voltage in amperage. With direct current only available, a converter must be used.

Low Cost Illumination

The cost of illuminating a neon sign is approximately one-third that of an incandescent lamp sign of the same size, due to the fact that neon has a power factor of only about 40 percent. This means that only about two-fifths of the current actually consumed is recorded on the meter. On an average neon sign the meter will register about 6 watts per foot of tube; thus a double-faced sign reading "Gas" in 15-inch neon letters would consume approximately 165 watts. At a five-cent rate such a sign would operate at a cost of slightly over 0.8 cent per hour for electricity.

The size, location and design for an electric sign should be given very thorough consideration. The reach of an electric sign—that is the distance up and down the street that its letters are to be seen and to be read—is a factor in determining its size. One must take note also of competing displays within a reasonable distance of a station's location, and certainly the sign must be of such a design

*Engineering department, Flexlume Corp., Buffalo.



THE FERRO MACHINE AN

Note these Engineering Features

FROM a strictly engineering standpoint, there is much in the FERRO Gasoline Dispensing Pump worth careful study . . . worth serious consideration.

Note its *simplicity*. The only moving parts are the shaft, with its two floating-fit rotors . . . the blades which contact with the rotor surfaces . . . and the rocker arm which maintains this contact.

Working parts are ground and hardened. Castings are semi-steel automotive cylinder block iron. Friction and wear are cut to a minimum by film of liquid under pressure between rotors and case . . . between pump shaft and bearings.

Exclusive features include accessibility of relief valve . . . strainer easily removable. Only two pipe connections—one for intake and one for discharge.

Spring-type stuffing box maintains seal for long period, is easily tightened by hand—easy to repack when necessary.

Spring-operated relief valve with pressure-damped dash pot prevents chattering of valve and agitation of liquid. Directly opposed position of rotors gives absolutely even flow . . . without a trace of pulsation.

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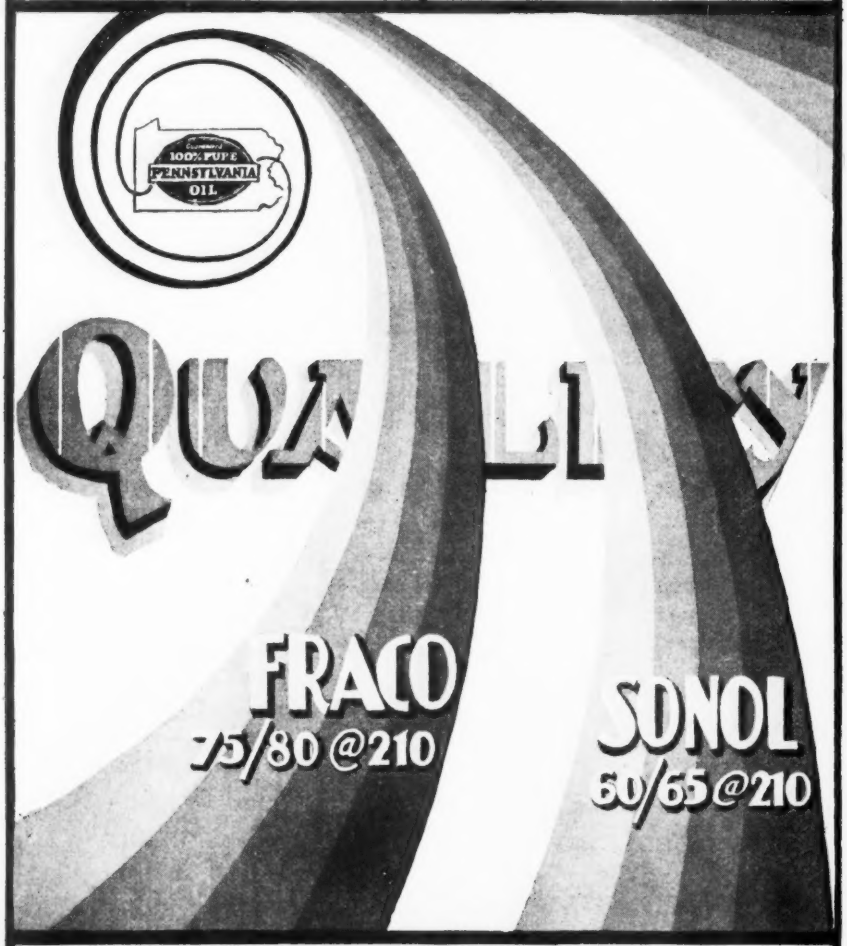

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The Pocket Viscosimeter that reads Saybolt Seconds direct—in a minute.

A necessity for handling
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Send for Booklets for Visgage and Dilutometer

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5638 Lake Park Ave. Chicago, Ill.

as to attract not merely attention but favorable attention. In many cases the most beautiful electric sign is a combination of a raised white glass letter sign with neon border or other decoration. This probably gives the strongest day and night effect to be obtained in an electric sign.

Motion or "kick" in an electric sign can be obtained by framing a sign of neon letters with a flashing exposed lamp border. If location of the sign is such that its range of view is short, double tube letters should undoubtedly be employed in order to rivet the attention of nearby observers with its brilliancy.

The correct size of the letters, of course, depends on the distance the sign is to be read. It is always better to make the letters large enough to take full advantage of the reach of the sign up and down the street. The following table gives approximate distances at which various sizes of letters will be visible.

4-inch letters	200 feet
8-inch letters	400 feet
12-inch letters	675 feet
24-inch letters	1300 feet
36-inch letters	1550 feet
60-inch letters	2500 feet
96-inch letters	4000 feet
144-inch letters	6000 feet

For greatest brilliance at night the color of the painted strokes of the letters behind the tubes should be identical with the tube color—that is, flaming red for red neon, blue for blue neon, and green for green neon.

For day value there should be a decided contrast in color between the stroke of the letter and the color of the background. It is well in order to emphasize this contrast to often times outline the letter with a narrower white stroke. However, if the letter stroke is made of a raised metal block the day legibility is greatly helped. Usually channel letters are to be avoided. They do not help the day or night legibility and they are the best dirt catchers yet invented.

Maintenance Is Vital

Only with proper maintenance can any electric sign reach its greatest effectiveness. As a matter of fact an electric sign that is not regularly serviced may turn out to be a trade deterrent rather than a trade attraction. In nearly every city and town of size in the United States and Canada there are competent sign maintenance organizations. Their services should be utilized by all electric sign owners.

Under average city conditions electric signs should be cleaned and inspected once a month. Where dust, smoke and dirt are not prevalent, service once in three months may prove sufficient.

If something goes wrong with neon or other type of electric sign the trouble can usually be discovered quick-

ly by one mechanically inclined. The better signs are furnished with a complete set of instructions so that if trouble develops the owner can determine the cause and report it to his sign servicing contractor. Regular sign maintenance men can usually detect symptoms of coming trouble and prevent it before it occurs.

Price of an all-neon sign is about 1½ times that of a raised glass letter sign or an exposed lamp sign. A double-faced electric reading "Gas" in 15-inch neon letters will approximate $240. An exposed lamp border added to the design will increase the investment to about $330. The same design of sign with 15-inch raised white glass letters decorated with a neon border—the whole a most effective day and night display—would run about $340.

Other Forms of Electric Illumination

A rapidly increasing amount of neon electric tubes is being used for strip lighting or outlining gasoline stations. This artistic decoration has been developed to a valuable one for any building and it costs only about $5 a running foot.

Businesses of all types have within the last decade come to realize that advertising right where the goods are for sale costs less and produces more. Thus hundreds of thousands of business establishments have and are continuing to spend vast sums of money for electrical advertising. It is a proven fact that an electric sign is the best advertising investment a business can make.

E. B. Dailey who gets 4-cent premium on gasoline at his station in Middleport, Ohio

Gets Extra Cent Premium On Anti-Knock Gas

MIDDLEPORT, Ohio—A 4-cent premium on anti-knock gasoline is obtained by E. B. Dailey, operating a service station here, while the usual premium on the same brand is 3 cents.

Sales have not declined to any appreciable extent in spite of his being 1 cent above his competitors, said Mr. Dailey.

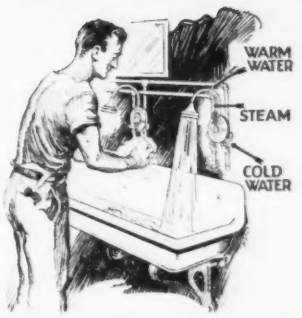
"Some customers ask why I get a penny more for my anti-knock gasoline," he said. "I just tell them that I think I'm entitled to a 4-cent premium in order to do business. I tell them that I water their battery free of charge, provide free air at the station, and do a lot of odd jobs on their motors that would cost them money at a garage. Then I tell them that, if they want to buy their gasoline for only 3 cents premium to go ahead; that I'm still their friend and will be glad to have them come back."

The 4-cent premium at Mr. Dailey's station came about through a series of service station price reductions this year in Meigs county. From a market of 20 and 23 cents gasoline dropped to 18 and 22 cents. About three months ago the price of anti-knock gasoline was lowered from 22 to 21 cents generally to maintain the usual 3-cent difference between anti-knock and competitive grade gasolines.

When the anti-knock price dropped to 21 cents Mr. Dailey decided to stand pat at 22 cents, believing his operating costs warranted a 4-cent margin. Mr. Dailey sells Indian Refining Co. products.

OAKLAND, Calif.—The S. T. Johnson Co., manufacturer of oil burning equipment, has appointed these representatives: E. Tucker, Sutter Creek, Calif., Bristol Electric Co., Bristol, Conn., Oil Burner & Supply Co., Cleveland, O., E. P. Knauer Co., Manitowoc, Wis., Warning Sheet Metal Co., Oshkosh, Wis., Ralph King. Atlantic, Ia., Peterson Roofing & Supply Co., of Mason City, Ia., L. C. McDill, Dunsmuir, Calif., J. Frank Boyer Plumbing Co., Norristown, Pa., L. G. Geberd, Ventnor, N. J., A. C. Rushlight & Co., Portland, Ore., S. & H. Engineering Co., Montreal, Oil Burner Service Co., Rockford, Ill., Raymond H. Bell, Jr., Columbus, O., and Andersen, Meyer & Co., Ltd., of Shanghai, China.

Low Cost Warm Water Supply



After Testing one of these little Steam & Water Mixers The Gulf Refining Co. Bought 28

Thousands of these money-saving mixers are being used in Industrial Plants, Y. M. C. A.'s, Hospitals, Hotels, etc. because they provide a low cost warm water supply for shower baths, wash sinks, car washing, etc.

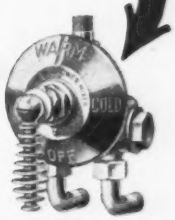
Steam at 10 to 100 lbs. pressure and cold water at any pressure piped to this POWER Steam and Water Mixer will give you COLD—WARM — or HOT water instantly.

It maintains whatever temperature is desired, *regardless of pressure changes in steam or cold water lines.*

Positively safe against scalding — no "shots" of cold or hot water — **no noise or water hammer!** It is not thermostatic. It is ruggedly built of bronze and monel.

Write for Bulletin

using coupon below



THE POWERS REGULATOR CO.
2720 Greenview Ave., Chicago, Ill.

Gentlemen: Please send me a copy of your Bulletin No. 258, giving full details and prices of the Powers Style D Steam and Water Mixer.

Name.....

Firm.....

Address.....

Long Range Signs Pull Motorists In; Window Displays Sell Him

By O. C. Taylor

CHICAGO

IF A sign draws business into a service station, it is a good sign.

Careful observation shows that signs can be so large as to not impress the motorist with their message. It is the sign that fits into the vision as a unit and creates its impression instantaneously that fulfills its mission.

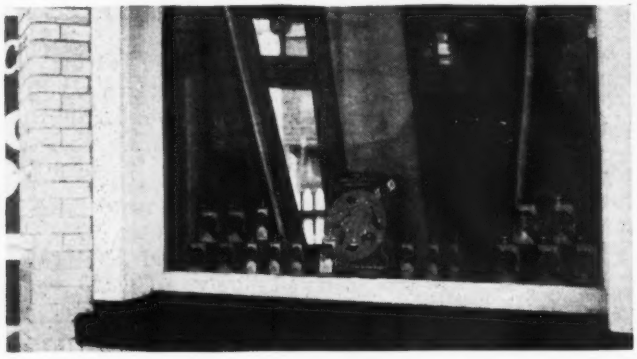
If the sign is so large that it blends into the landscape, as many do, it escapes us entirely. Signs on walls of buildings are apt to be missed entirely, if too large.

Signs that are too high are easily overlooked. With the low visibility of present day cars, this becomes an important factor. Seemingly, little attention has been paid by station owners to the visibility of their signs. In the middle of the block, the average motorist is thinking of other things beside what may be at the corner, even though he knows that he will be obliged to stop soon for supplies.

As he approaches the corner, he is apt to glance hastily at the corner to see if it has a station. As he glances, the sign of the station should be so placed that it will "bang him in the eye" and cause him to turn in. Inasmuch as the decision is made in a brief space of time, the sign should tell its story briefly and effectively.

He grasps instantly that there is a station there, so the sign that says merely, "Gas" neither surprises nor sells him on coming in. He wants to know what kind of gas he will get if he turns in. Many motorists have agreed that the sign that identifies what is sold at a station arouses their confidence much more quickly than the mere word, "Gas" on a sign.

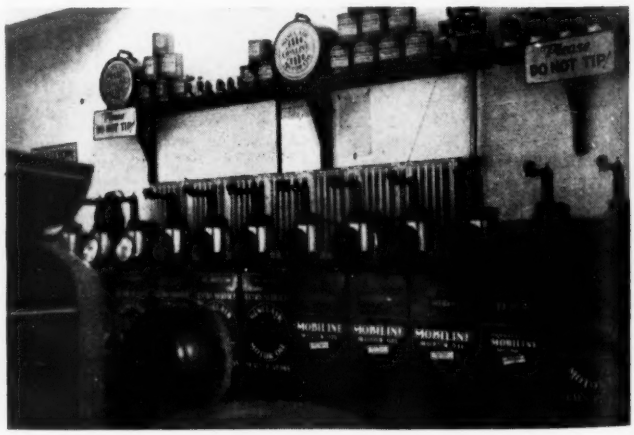
Most motorists have a favorite brand



Proof that a window display at stations sells goods is seen in this photograph taken from the auto as it was being filled with gasoline. The irregularity in the display of household oils was caused by sales. The card illustrated uses for the household oil, and suggests "Take home a can. We sell it"

Insect spray is advertised to customers through this station window. The photograph indicates the view of the customer as he looks from the side of his car at the gasoline pumps

A window display of package goods and accessories to be purchased in the station



Good display at the front end of an indoor lubrication station. Motor oil is stored in drums at the head of the pits. On the shelf are package goods of soap, grease and oil

in mind that they will buy if it is available. When, however, they are in a far country, where the favorite brand is not obtainable, they are at least given the opportunity to choose if they see a brand name on the sign. Seemingly, people resent not being told frankly what is in store for them if they should turn into the station.

Innumerable cases have been encountered where one would be almost past a station before he could determine the kind of station it was. In this day of fast traffic, this invariably means the loss of a sale.

In many cases, attention getting signs have been placed properly but other signs have been later placed so as to obscure them. Trees hide the messages of untold signs that would otherwise convey a welcome invitation to passing motorists.

A sign that did a good job six months or a year ago, may not be doing one today. An occasional survey of one's signs may be very beneficial to the station owner.

Inside the station, there is a field for advertising that is apparently being overlooked. Here, the driver of the car relaxes from the strain of traffic and is more receptive than at any other time to a message that is calculated to sell him something.

Here we find signs placed too high—on station walls or other places where the motorist is apt to miss them. One placed so that the driver will see it straight ahead as he stops at the pumps can be designed to tell him a message that will increase sales effectively. A story about the advantages of having crankcase drained should result in many an extra draining, if properly and briefly phrased.

Tracks painted on the driveway and leading to the drain lift, pit or rack, would in many cases cause the waiting motorist to decide to have extra service for his car. If the sign indicated that all he had to do would be to follow the track, it would comprise a suggestion and show him how that suggestion could be followed with little effort on his part—and lots of people like that.

A potent message and sales talk would be very effective if placed so that the motorist would see it after he had driven onto a lift, rack, or pit. A suggestion about having his car thoroughly greased, brief but effective, could be made to still further increase his purchases.

Many stations observed looked as though they were the victims of some sort of sign hanging contests. Signs placed without regard to proximity, size, color or taste, in wild profusion were common. That each sign should stand alone if it is to convey its message to the motorist, is obvious. Otherwise, the whole presents a blur that deprives any one sign of the advantage of appeal.

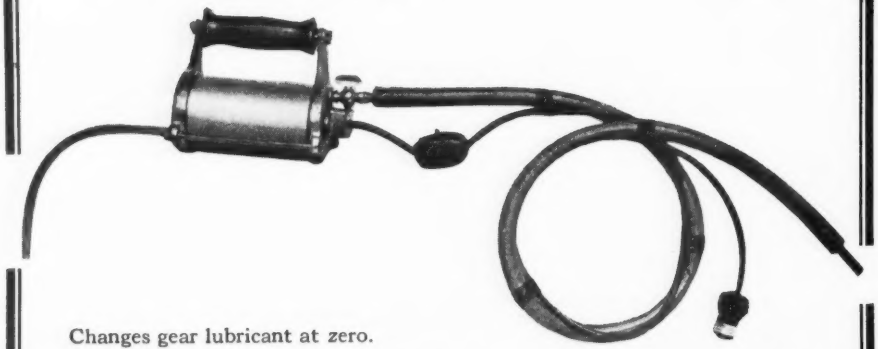
One field of vision for signs that has apparently not been given much if any consideration is that of the

A good sign handicapped in its sales appeal by being hidden among the trees out of view of the approaching driver

This sign appeals to motorists on a price basis. It does not identify the goods sold at the station

Eight signs placed along the curb to attract customers. The signs advertise two grades of gasoline and two grades of motor oil

Introducing the Gresmelt

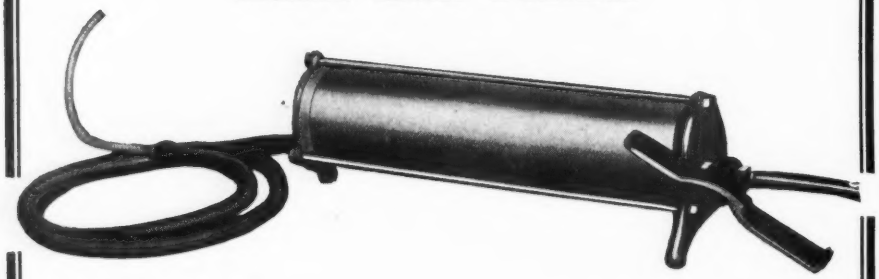


Changes gear lubricant at zero.

The gresmelt electrically heats compressed air, and forces it into the cold, hard grease in the gear housings, warming it to the constituency of motor oil in a few minutes, solving the winter draining problem at last.

Thaws out crank cases, radiators, frozen fittings and shackles, and eliminates the dangerous and disagreeable use of blow torches, steam and other hazardous make-shift methods.

Lubri Gear Flusher



Fast, durable and efficient.

Simple in construction, operated by compressed air, and centrally controlled by one foot pedal, permitting the use, by both hands of a special flexible nozzle, designed to transmit the powerful suction and discharge of this machine.

Flushes transmissions and differentials to the complete satisfaction of customers and operators.

For Full Particulars Address the

LUBRI APPLIANCE COMPANY

Adrian, Mich.

HIGH GRADE PETROLEUM PRODUCTS

Made by the Oldest Pennsylvania Oil Refiners

CYLINDER STOCKS, (Filtered and Unfiltered).
MOTOR OILS—to match any specification.
High Grade Burning Oils.
300° Mineral Seal and Railroad Oils.
High Grade Transformer Oils.

A. D. MILLER SONS' COMPANY
PITTSBURGH, PA.

low sign, below the center of vision. Experiments show that most motorists are apt to drop their eyes in order to rest them after a tiresome drive. A sign placed near the ground but tilted back so that it could be easily read would be both novel and appealing. Some instances were observed where signs were leaned against the building at stations but, unfortunately, they were on the opposite side to the driver of a car.

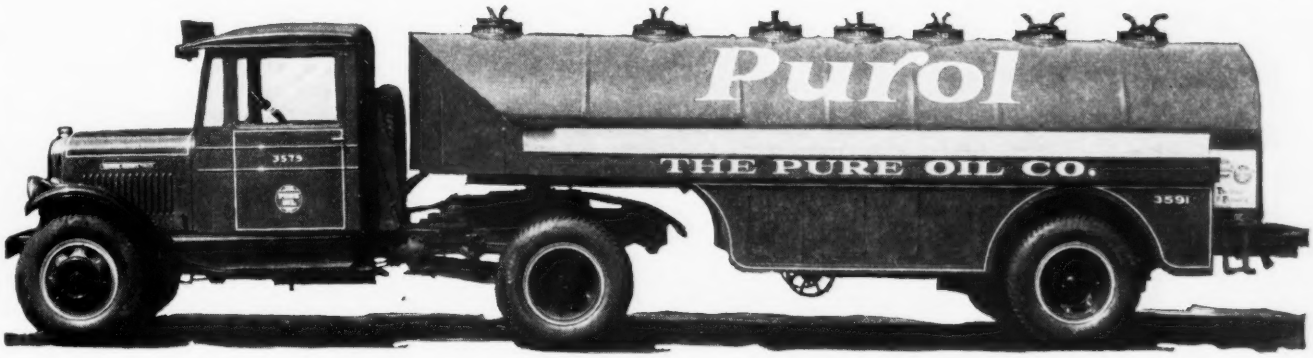
In many cases, tilted signs could be placed so that they would be at the left of the car as it stopped at the pumps and, with a pertinent suggestion, would be sales builders.

Signs, obviously, have the same duty to perform that have all other forms of advertising—that of creating a favorable impression. Generally speaking, service stations, in many cases, create impressions bordering on the unfavorable because of errors of omission and commission in regard to signs and their placement. Those put out by oil companies today are issued only after a great deal of thought has been given to their appearance and the message to the motoring public. A little care and attention to the placing of these signs should prove a profitable investment.

DETROIT—The General Motors Radio Corp. has been organized to enter the radio business after an agreement concluded recently with the Radio Corp. of America, General Electric Co., and Westinghouse Electric & Mfg. Co. The new General Motors company is capitalized at $10,000,000.

C. M. McNutt is president and owner of the C. M. McNutt Oil Co., engaged in El Paso marketing. He was elected vice president of the Texas Petroleum Marketers Association, representing the El Paso district, at the recent meeting of the T.P.M.A., at San Antonio

"On The Job
... day in and day out!"



. . . Pure Oil Company's Tribute to General Motors Trucks!

THE Pure Oil Company maintains delivery service of high caliber. Routes are timed with clock-like precision that gets "PUROL" Products to retail outlets and consumers exactly on schedule. Equipment that doesn't do its full share is soon eliminated.

Big factors in maintaining this high standard are the many General Motors Trucks included in the Company's fleet, according to Mr. Leo Huff, General Manager of the Motor Transport Division.

"The ability of these trucks to make time under load, and the fact that their ruggedness keeps them on the job seven days a week, is mighty gratifying to us," he states. "In our producing fields, also, General Motors Trucks are giving fine accounts of themselves."

This General Motors Truck with flat bed body, is another of the many G. M. T. units which are performing so successfully for The Pure Oil Company. It is in service in the company's Oklahoma and Texas producing fields.

* * *

Anyone who is in contact with men in charge of oil transportation constantly hears fact-recitals like this about the impressive records General Motors Trucks are rolling up. Speeding up delivery. Establishing new performance peaks in actual work. Reducing costs. Advertising their owners' products by their handsome appearance, quietness and safety in traffic. Giving tens of thousands of miles of efficient transportation long after flimsier vehicles have become profit-eating liabilities.

Investigate this complete line of proved profit earners. Write, phone or call.

General Motors Trucks

GENERAL MOTORS TRUCK COMPANY, Pontiac, Mich. (*Subsidiary of* Yellow Truck & Coach Mfg. Co.)
GENERAL MOTORS TRUCKS, YELLOW CABS and COACHES
Factory Branches, Distributors, Dealers—in 1500 principal cities and towns
(*Time payments financed through* Yellow Manufacturing Acceptance Corporation *plan, at lowest available rates*)

ALWAYS INVESTIGATE WHAT GENERAL MOTORS HAS BEFORE YOU BUY

Lifts for Indoor Lubrication Appeal to Customers

CHICAGO

PUBLIC demand for lubrication service in full view of the customer has brought the lift into favor for indoor lubrication departments—such is the sentiment of station operations and owners in Chicago and Cleveland. Convenience of working quarters, cleanliness of workmen and surroundings are factors favoring the lift, but "public demand" is given first consideration.

From the company's point of view also advantages are being seen in the use of the lift indoors. For one thing lifts, instead of pits indoors, means that the ordinary type of building can be used. This represents a saving to the oil company if changes in the station departments are made later and space formerly used by the lubrication department is given over to something else.

Where pits are used, the space at the station must always be given over to this purpose, or considerable expense entailed in changing over the floor and basement of the building. Station owners with leased properties can move lifts at no great expense and have them for use elsewhere.

The lift also affords a means for contact between the customer and the station, operators say. As a rule the customer stands around, watching the work on his car. Possibly he is having his first look under the floor boards. Questions naturally come to the customer's mind, and the way is paved for conversation. For the intelligent workman this conversation can be turned to good use in forming a contact with the customer.

At least 75 per cent of the customers watch the men work on their cars, estimates T. J. Nelson, greasing foreman of the Super Service Station, Inc., station at 5719 Broadway, Chicago, where lifts are used indoors.

"Of course we do a real greasing job that brings them back, but the equipment attracts them in the first place. At least 75 per cent of the customers watch the men work. Most of them ask questions and I can see where that is forming a business building contact in nearly every case. It is tying the customer to our station.

"Sixty-five per cent of our customers have their cars greased when they have other work done here—only 35 per cent have oil changed only. I attribute the high percentage partly to the fact that the equipment impresses them as being up-to-date and thoroughly business-like," said Mr. Nelson.

THIS factor of the "public wanting lubrication service in full view" was the first reason for favoring the lift given by Paul Porter, in charge of lubrication for the Standard Oil Co. of Ohio's station at Carnegie ave. and E. 89th st., Cleveland.

"Customers want to see the work being done on their cars," he said. "They are skeptical of lubrication service done out of sight. Customers like to watch the workmen and check up on the work. Many times the customer is getting his first look under the floor boards.

"The lifts help us keep the place clean. It is a job to keep these tile floors cleaned up, but it pays."

That customers want to see work being done on their cars was given first consideration also by workmen at Standard of Ohio's lubrication station in Lakewood, a suburb of Cleveland.

Cost of operating a lift was not considered a big item in operating a lubrication station. D. H. Stearns, manager of Super Service Station's Broadway plant in Chicago, estimates that the cost of compressed air to lift the average auto is about the same as the cost of air to inflate the average tire. The cost varies with the weight of the auto.

Lifts at the two lubrication stations of the Standard Oil Co. of Ohio mentioned above are operated on air supplied by two compressors in tandem, each having a five horsepower motor. These compressors build up a pressure of 175 pounds, and are set at a minimum of 125 pounds.

These two compressors provide all

Lubrication department of a station of The Texas Co., Joliet, Ill.

4 READ THESE 4 ECONOMIES OF BLACKMER PUMPING UNITS

1. Blackmer Rotary Pumps actually cost less than other types of pumps, such as piston, etc. In other words, less money has to be charged off each year for pump depreciation. There is less capital invested—there is less money tied up in the equipment. Blackmer Rotary Pumps, from the standpoint of first costs, are exceptionally economical.

2. Blackmer installation costs are less. Before leaving our factory every Blackmer Pump is thoroughly tested. It must prove perfect in our hands first, so that when installed you are assured the utmost satisfaction.

The Blackmer Pump takes up less floor space. Pipe connections can be made quickly and easily. All details have been carefully considered so that beginning with the installation, each Blackmer Pump is a real economy, through and through.

3. Because of the well-known Blackmer principle of construction, and because of the fact that they are rotaries, our pumps require less power to run. The continuous action of the Blackmer Pump results in less power required, with the consequent result that cost of operation is appreciably reduced. Blackmer Pumps have a positive suction and need no priming. They require little attention while in operation.

4. One of the most important of all Blackmer economies is the ease with which replacements can be made when parts become worn. By simply replacing the buckets, an old pump can be made practically as good as new. There are Blackmer Pumps still in operation which have outworn two, three and four motors.

Mail coupon now for interesting, helpful booklet.

FREE— The interesting booklet, "The Secret of Hydraulic Balance," which every man, having anything to do with pumps, should read.

BLACKMER PUMP COMPANY

1801-B CENTURY AVE., GRAND RAPIDS, MICH.

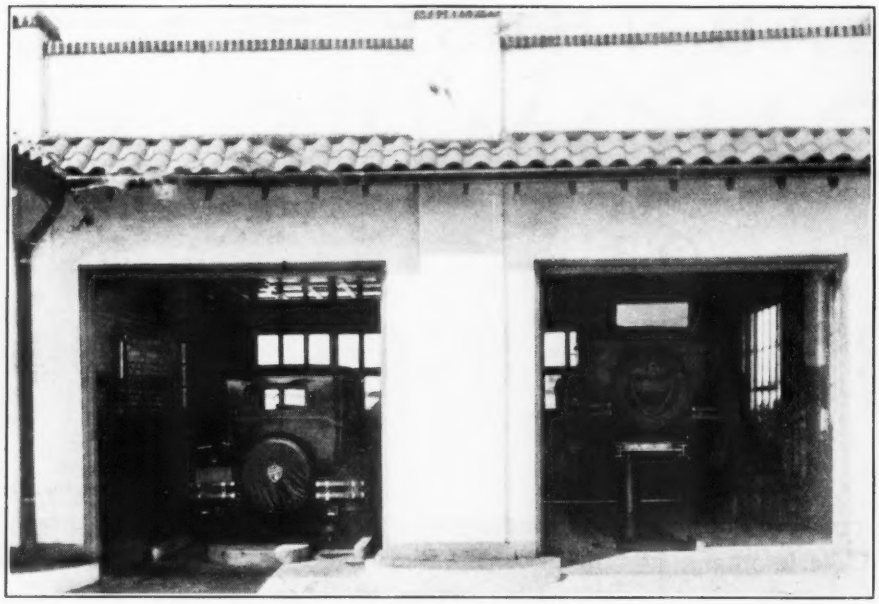
BLACKMER PUMP COMPANY
1801-B Century Ave., Grand Rapids, Mich.

Please send me without obligation, a copy of your booklet, "The Secret of Hydraulic Balance".

Name .....

Address .....

.....



Lift and pit at a small station

air required for the stations. In addition to the five lifts, there are four 2000-gallon underground gasoline storage tanks on air, and lubricating oil is kept on air at each station. There are four tire inflating reels at the Carnegie ave. and two at the Lakewood station.

Recently two additional lifts were installed at the Carnegie ave. station, bringing the total to seven. Company officials believe that additional compressors may have to be installed on account of the extra load.

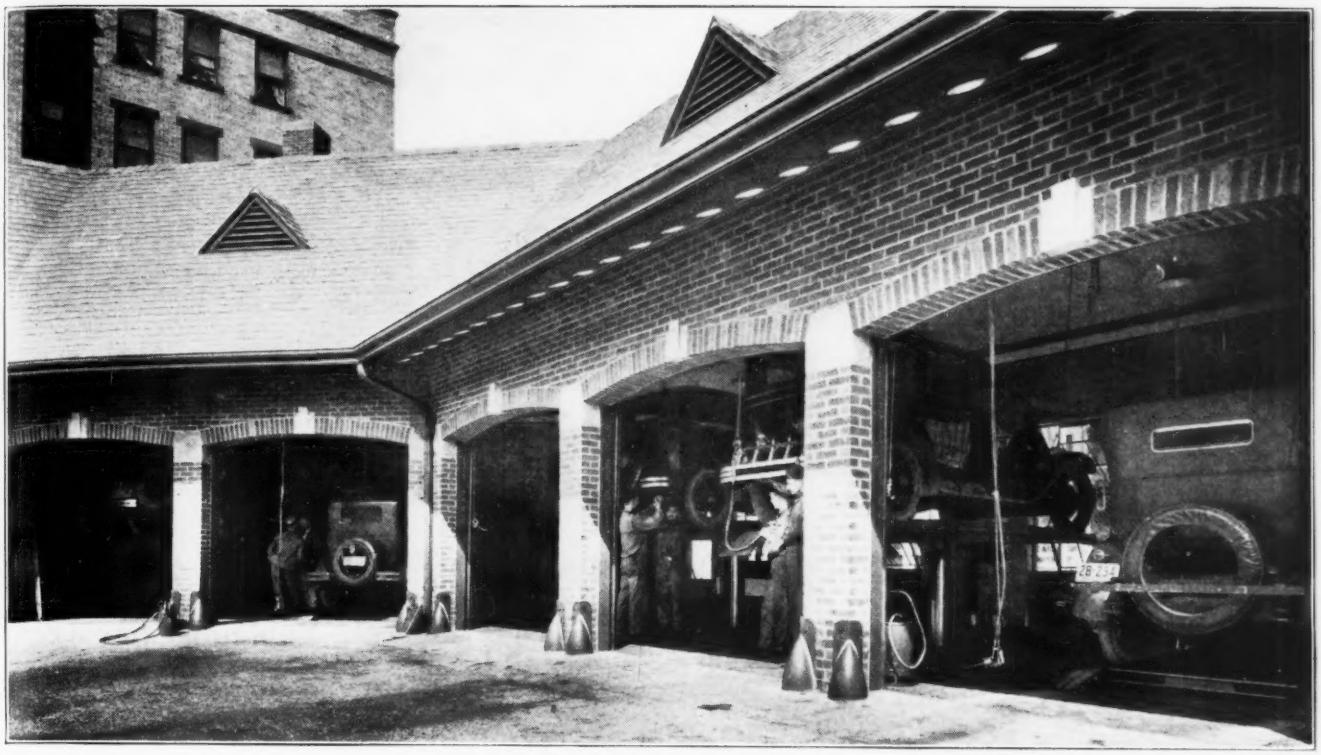
The manufacturer of the lifts used by Standard of Ohio recommends that a pressure of 100 pounds of air be maintained at the end of the lift period. Standard Oil officials estimated that compressors seldom were called on to lift more than one car at a time. Even if several cars entered the station at the same time they believe there was a sufficient gap so that all would not be lifted at once.

Adaptability is another feature of lifts for indoor lubrication service. The garage in the Terminal buildings on Cleveland's public square was considering lifts. Plunger types of lifts were not acceptable as no part of the lift could extend downward on account of interfering with the floor below. Types of lifts manufactured are diversified, and the garage installed a lift which has a frame resting on the floor.

Space required for a lift indoors is slightly more than the length and width of an automobile, plus a ceiling about 14 feet high. The Standard Oil stations in Cleveland are in rooms with 14-foot ceilings. The two lifts installed recently in the Carnegie ave. station are in rooms with 11½-foot ceilings, and care is taken in raising a car, especially the older type with high tops.

Lifts can be installed in buildings not having the required ceiling height by depressing the floor. A 15-inch excavation at the Glenridge service station, Glenridge and Ridge aves., Chicago, allowed the installation of lifts without alterations on the struc-

The five lifts at a Standard of Ohio station in Cleveland



Exterior view of a Standard of Ohio lubrication station in Cleveland

ture. At this station outside pits were enclosed, and later on the pits were replaced by lifts. To obtain the required ceiling space the floor was depressed 15 inches.

C. N. Black, son of the proprietor of the Glenridge station, states that he is enthusiastic about the lifts for indoor lubrication. "Lifts allow more space, and more light in the room, and attract customers because of the up-to-date appearance," he said.

From the standpoint of the workman the lift is attractive. His working quarters are more pleasant on account of the cleanliness of the station. He is able to work in an erect posture. He can keep his uniform cleaner, which in turn is a factor in his mental attitude towards the job, as well as a factor in keeping the customer's car cleaner.

TOOLS and equipment are in full view, making for an orderly arrangement. In the Standard of Ohio stations the air lines are on reels in the ceiling. After a car has been hoisted the air line runs up, out of the way. Greasing equipment is kept along the back wall, or arranged in the space between lifts.

The safety device on lifts is the hissing noise made by escaping air. It is estimated that the average time for raising or lowering a lift is about 22 seconds, allowing time for the workman to get from under the car. The noise is different from that of any other about the station. When the release valve on the air line is opened, or when a line breaks, this noise begins and continues until all the air is gone. Frequently there is an interval between the time the air begins to escape and the beginning of the downward movement of the lift.

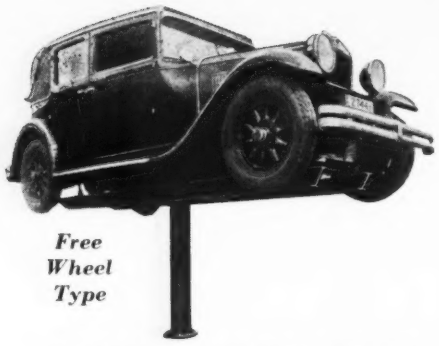
The workman also has the opportunity of establishing customer contact, which ties the customer to the station as well as to a particular workman. In addition the workman may sell a complete lubrication job when the customer drove in only for an oil change.

Conversation is started with the customer watching the workman. If bolts are loose, or a spring leaf broken the workman can bring this to the customer's attention, a little service that impresses the customer. A workman can show the customer the condition of the lubricant in the transmission. Mr. Porter, at the Standard Oil station, credits this transmission level demonstration as giving the station an advantage in case a garage should attempt to blame the station for a dry transmission.

The lift also keeps the workman in full view of other customers driving in. From the customer's viewpoint he sees signs of activity about the station. From the workman's viewpoint he can give a sign of recognition without interfering with his work, and still let the new customer know his entrance has been observed.

Two lifts in operation at a small station

Our contribution GLOBE



Free Wheel Type

SAFER-QUICKER-BETTER

"Hi-Preg—Unit Construction"

Globe Auto Hoist is as unique in its construction as it is in performance. Like many other lifts, Globe Hoist operates hydraulically by air pressure on a column of oil. But the secret of its many advantages lies in the "hi-preg"—"unit construction" principles. "Hi-preg" refers to a cup leather attached to base of piston, which is tightly held against the highly polished inner wall of the cylinder. When the oil enters the cylinder it forces the lip of the cup leather against this polished surface. Thus a perfect seal is formed and the piston is raised. All oil is kept underneath the base of piston, and every ounce of air pressure is given a chance to do its full share of lifting.

Every detail in the use of raw materials, in the construction of parts, and in assembly have been attended to with painstaking care. The result is safer, quicker and better operation at all times of the year, under all conditions.

SEVEN

superiorities of Globe Auto Hoist

1. No packing gland nuisance
2. Minimum maintenance
3. Less air required
4. Fully rotating in either direction without binding
5. No surface drainage
6. No oil leaks—oil tank below frost line
7. Quick, low-cost installation.

YES, Globe Auto Hoist *is* a contribution to your success. You must pay a reasonable price for it, of course, but it's a real contribution in the sense that you benefit in actual dollars and cents—almost instantly, more than the amount represented by the purchase price.

Without a doubt, Globe Auto Hoist is one of the finest investments you could make. Its value lies, first, in the mechanical features that distinguish it. But more important than that is the magnetic power of this Hoist to attract and *hold* business. Globe Auto Hoist is a successful salesman—a builder of business—a modern tool for today's work. In every case where Globe Hoist is put to work it brings immediate results, both in greasing and car-washing, as well as in gas and oil sales.

A higher type of GREASING SERVICE

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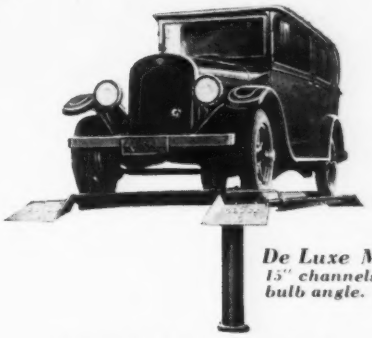
THE BUILDER OF

U. S. Patent No. 1,720,920, other patents pending

to your success — HOIST



De Luxe Model
15" channels with bulb angle.

YEARS OF SERVICE

The prestige that Globe Auto Hoist has won is directly traceable to the superior performance of the Hoist itself—to the remarkable backing that every purchaser receives through the well-known Globe Merchandising Plan—and to the widespread need for just such equipment as this Hoist. It stands alone—the leader. No similar equipment can take its place.

Whether or not you are planning the purchase of an automobile lift, you owe it to yourself and to your business to investigate the rare possibilities that are offered you only by Globe Auto Hoist. Clip and mail the coupon today without obligating yourself. Give us a fair chance to show you the benefits that will accrue when you have a Globe Hoist in your establishment.

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205 W. Court Avenue
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A Merchandising Service that pays!

Besides getting a piece of equipment that is *known* to be of the highest type, every purchaser of Globe Auto Hoist becomes the recipient of numerous invaluable services. The Globe Merchandising Plan was planned and put into operation for *you*—to help you in all your business efforts. It *makes* each Hoist pay big dividends, and assists materially in the boosting of your total profits. A few of the services that compose the famous Globe Merchandising Plan are: Newspaper advertising—direct mail literature—circulars, folders, leaflets, etc.—billboards and roadside signs—Globe Hand-Book, (authoritative treatise on the potential profits available at every service station and garage)—station layout, and other services that are of vital importance in the operation of your business. The Globe Machinery & Supply Company backs and cooperates with each customer to the limit. Our work really begins with the installation of your Hoist.

USE THIS COUPON

Globe Machinery & Supply Co.,
205 W. Court Ave., Des Moines, Iowa.

Please send me facts about Globe Auto Hoist, and tell me exactly in what way it can help me earn bigger profits.

Name.....

Address.....

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BETTER BUSINESS

Underwriter's Approval—Listing 546, July 16, 1929

Cranes and Tractors Cut Labor Cost

CLEVELAND

COMBINATION cranes and clamshell diggers operated with light oil engines mounted on truck chasses are now used by some of the large oil companies for work in producing fields, around supply yards and in refinery, gasoline plant and bulk station construction work.

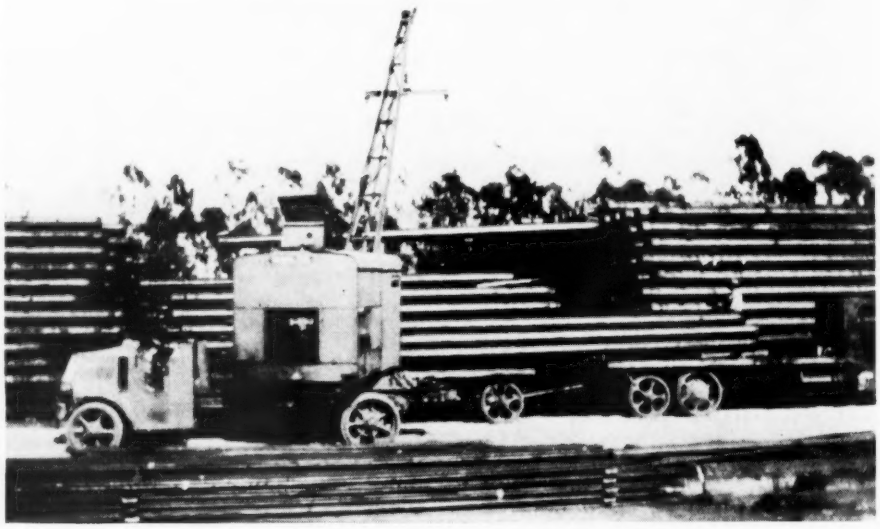
These cranes when used either for handling heavy equipment or supplies or for excavating not only greatly shorten the time of doing a given job but they are able to save the cost of wages of many men.

One crane, reports the Universal Crane Co., of Lorain, O., that is in use by the National Supply Co. in the Santa Fe Springs oil field in California, is capable of handling 3000 tons of casing a week.

Heavy duty tractors and road machinery also are finding uses in Oil company construction work. Levelers drawn by tractors are being used in preparing the sites of new refineries and extensions to refineries. Oil field roads are also made with the modern machinery. Beds for large storage tanks also are being leveled with tractors and scrapers.

Photo by Universal Crane Co.

Clamshell digger mounted on truck chassis, making sump in Santa Fe Springs oil field in California



Universal truck crane handling well casing at Santa Fe Springs

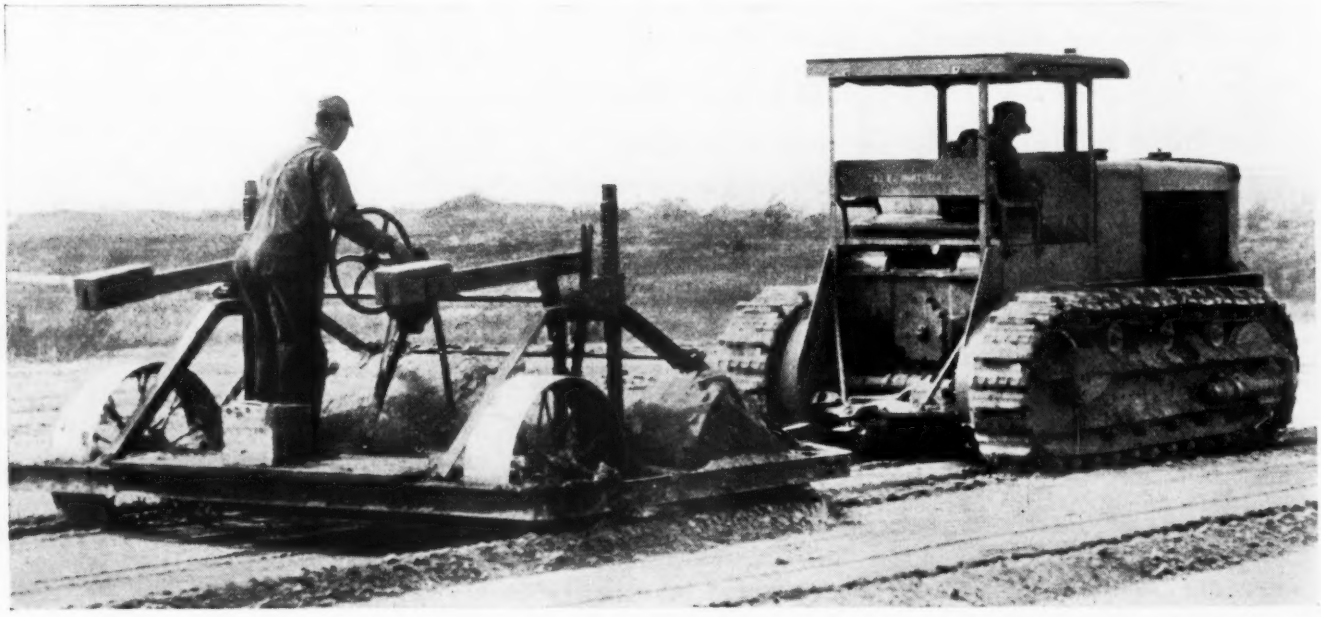
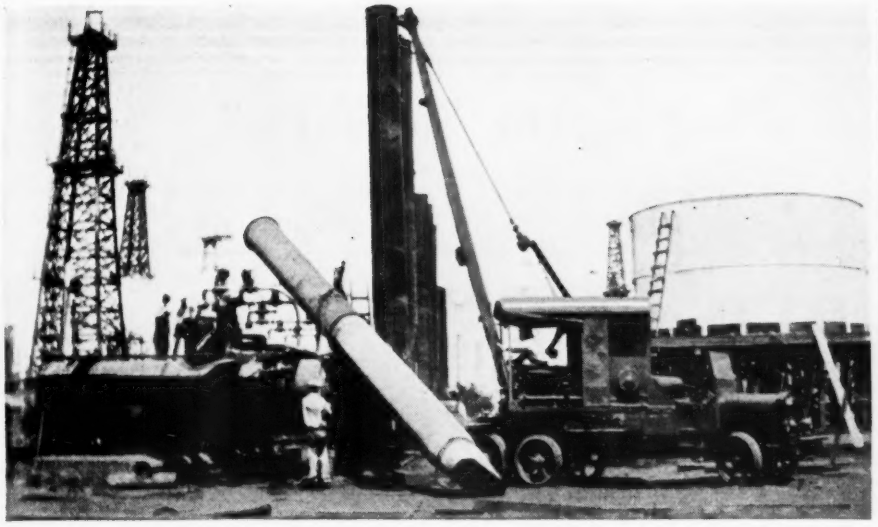


Photo by Allis-Chalmers Mfg. Co.

Tractor and scraper leveling refinery site at East Chicago, Ind.



Truck crane helping erect battery of boilers for Standard Oil Co. of California at Santa Fe Springs

Gasoline Automobile Is Electrically Driven

CLEVELAND, Oct. 25.—A gasoline-electric automobile has been produced jointly by the General Electric Co. and Rauch & Lang Corp. for Col. E. H. R. Green, son of the late Hetty Green. No announcement has been made as to whether these companies plan to put the vehicle into commercial production.

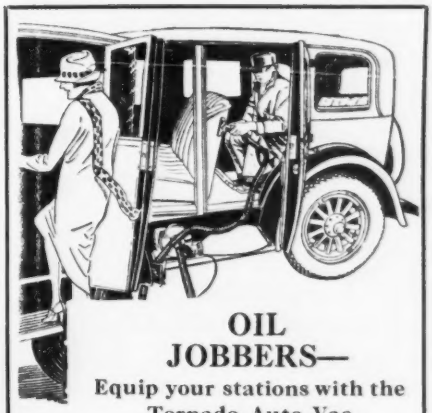
The car has a gasoline engine under a front hood just as the present gasoline automobiles have, but a generator is attached to the flywheel housing. The generator provides power for an electric motor under the front seat and the drive is by means of a short shaft to the rear axle.

The car has no gear-shift lever and no clutch pedal. On the floorboard are two pedals, a brake for the driver's left foot and an accelerator pedal for the right foot. To the left of the pedals is an emergency or parking brake lever and to the right is a starter button.

The gasoline engine is started in the ordinary way. At the slower speeds of the engine, insufficient electricity is generated, it is said, to turn the motor but as the engine is speeded up an automatic electric control will cause the motor to pick up and start the car. To decelerate it is necessary only to cease feeding gasoline to the engine. To reverse the car, a small lever actuates a switch which reverses the flow of electricity to the motor.

Speed is controlled by the supply of gasoline. In the car supplied Col. Green the maximum speed is 40 miles an hour but engineers who developed the vehicle say that by changing the gears speeds usual in gasoline automobiles can be attained.

Col. E. H. R. Green in his gasoline-electric automobile. The top on this car is high enough to permit Col. Green to enter without stooping, hence the high windshield

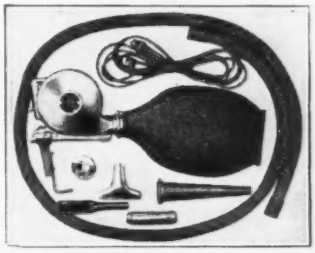


OIL JOBBERS—

Equip your stations with the Tornado Auto-Vac

Give your customers a 100 per cent vacuum cleaning job with the new TORNADO Auto-Vac Cleaner—the most powerful and efficient commercial auto cleaning device ever built. Hundreds of oil jobbers have standardized on the TORNADO — stimulates sales! Attach this advertisement to your letterhead and mail for special offer to oil jobbers. No obligation.

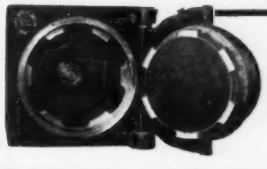
Breuer Electric Mfg. Co.
860 Blackhawk St., Chicago, Ill.



Put Your Cash where he can't get it!

The inner door or "hold up" partition shown on the chest illustrated below will enable the filling station operator to place all money, except enough to make change, thru the slot where the thief cannot get it. As the station operator does not have the combination, the hold-up man cannot force him to surrender it.

YORK SAFE & LOCK CO.
YORK, PA.



The York Round Door Chest with "hold up" partition.

The Super Fuel—

SUPER-RATIO

BY DERBY

ORDINARY gasoline is made to give best results under low compression. Derby Super-Ratio is a high-compression gasoline. Made to fire under high compression. It is 10 to 15% more efficient in low compression motors and 25 to 35% more efficient under high compression than ordinary gasoline. And whether your motor is designed for high compression or has developed a carbon deposit, Super-Ratio will never "knock".

Initial 85/90—End Point under 400—Gravity 62/64, and with a Benzol equivalent of better than 50%, Super-Ratio comes out of the refinery a volatile gas. Even in coldest weather it vaporizes instantly. Delights motorists who have had trouble with slow-starting gasoline.

High gravity and quick vaporization also contribute to the smooth "pick-up" qualities of Super-Ratio. This is largely due however, to its complete combustion and the fact that it never knocks, which means no loss or waste of power.

Super-Ratio explodes with a powerful push, not a quick knock. Burns completely. All the power in every explosion is completely utilized. That can mean only one thing—*Maximum* power and mileage out of every tank full.

"By Derby"

We have told you that Derby Super-Ratio is good gasoline. It *is* good gasoline, that motorists will drive blocks out of their way to get. In addition, it has been thoroughly tested and is guaranteed to be as represented—By Derby. The name Derby has grown to mean Dependability and Honesty.

And if you want to build a business on your own name and reputation, you will appreciate the fact that you are given a chance to do that—By Derby.

It is to your own interest to

SUPER RATIO
DOE
MOTOR FUEL

BUY DERBY!

THE DERBY OIL & REFINING CORP.

Wichita, Kans. L. D. 177 — Kansas City, Mo. L. D. 94

Office and garage and tank yard of the bulk plant of the Standard Oil Co. of Indiana at Rockford, Ill.

All Valves Tagged, All Lines Marked For Safe Handling of Oil Products

By E. L. Barringer
N. P. N. STAFF WRITER

ROCKFORD, Ill.

A TORNADO swept Rockford, Ill., a year ago, wrecking the tank yard and warehouse at the bulk plant of the Standard Oil Co. of Indiana. On the same site a reconstructed plant now stands, incorporating the latest features of bulk plant design.

Precautions have been taken to insure the correct handling of refined oils in the new plant. All pipes on the tank car unloading rack through the tank yard to the truck loading stand are painted red. A color, other than red, has been assigned each product. All valves and fittings are marked with the color code to indicate what products pass through the lines.

Metal tags are attached to all valves indicating what commodity passes through. This information also is stencilled on the line at the valve as a double safeguard.

Chance of mistake is avoided in the pump house by assigning a pump to an exclusive commodity, or one pump to similar grades of goods. Take the handling of Red Crown Ethyl gasoline. One pump moves all this grade from tank car through to storage. Another pump handles Red Crown and Solite grades of gasoline exclusively. Another pump handles kerosenes and another the burner oil. These four pumps are in one battery driven by an electric motor.

A second battery of four pumps moves four grades of naphthas. These pumps are rated at 135 gallons a minute capacity. The only pump manifolded is that for burner oils, as this commodity is stored in an upright tank, then transferred to an overhead tank for gravity loading of trucks.

In line with the policy of multiple marking of pipes, special precautions are demanded of workmen in unloading tank cars. The first step is to place a sign reading "Stop, Tank Car Connected" or a red flag at the open end of the switch. Next the car is gauged for outage.

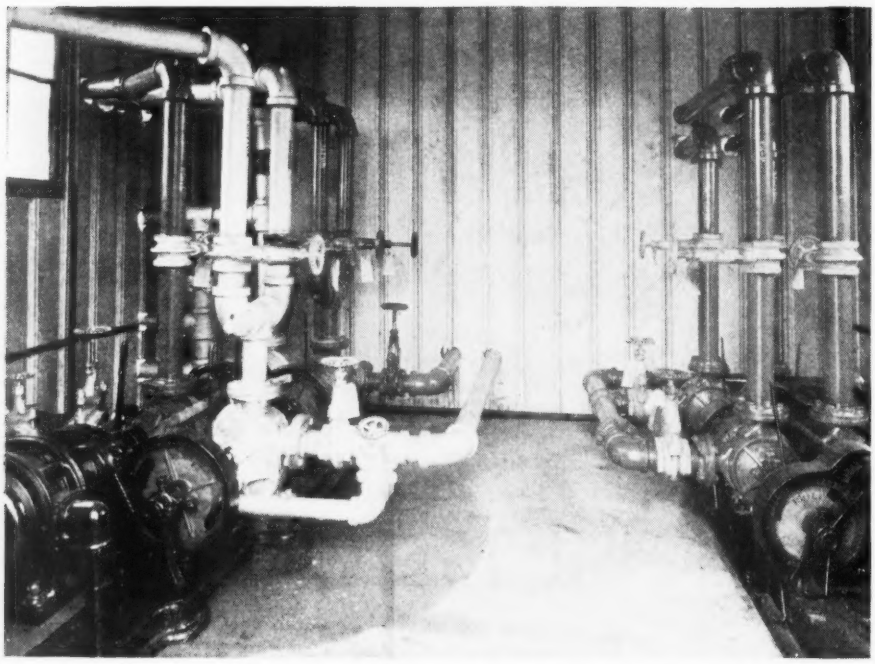
H. H. Bogardus

Agent for the Standard Oil Co. of Indiana, at Rockford, Ill. Mr. Bogardus is the son of Edgar Bogardus, assistant to the vice-president, of the Standard of Indiana

The workman then gauges all storage tanks containing this grade of goods to make sure what each tank will hold. The overhead suction pipe is placed in the car. A wet piece of burlap is placed at the dome opening to keep out cinders and sparks. All valves on the unloading line, pumps and storage tanks are checked and opened, and the car is unloaded. After a tank car is unloaded all storage tanks are checked again. This final check is compared with the first one as another check on the tank car's contents. Also, the workman at the tank yard knows definitely the contents of the tank. The office is notified when a car is unloaded and calls the railroad.

Precautions have been taken also to safeguard workmen and the plant from explosions and fires. In case of fire in the tank yard outlet valves on all tanks would close automatically. On the outlet line of each tank is a gate valve and a float valve, the gate valve being farther from the tank. After the gate valve is opened the float valve is kept open by a weight hung on a rope. In case of fire the rope would burn, release the weights and close the valve.

Fire extinguishers have been placed about the buildings and yards. To protect those outdoors from cold weather, the extinguishers are housed in heated wooden boxes lined with asbestos. Heat is obtained from a



The eight pumps in the refined oil pump house. All valves are tagged, and lines stencilled as to what products pass through

75-watt electric light bulb. The light is in a horizontal position at the bottom of the box. The extinguisher rests on a shelf, with a hole in the middle, directly over the light. At the bottom of the door is red glass so workmen can find the extinguisher at night.

All motor switches in the plant are immersed in oil to prevent sparking. All electric wires are in conduits. Electric lights in the pump house, warehouse, barrel cleaning room and at the loading rack are in vapor proof globes.

All construction about the plant is fireproof. The only wood at the tank yard and truck loading rack is the walk and railing on top of the tanks. In the warehouse all floors are of concrete and all doors, except those in the agent's office, are of steel. The platforms around the warehouse are of concrete and steel. Trucks at the loading rack are grounded twice—the customary drag chain and a contact on top of the truck through the loading rack frame.

The refined oil pump house and the barrel cleaning room have air vents at floor level. In the pump house these are about one foot square, one at each side for cross ventilation. In the barrel cleaning room there are two on the end, and one each on the sides.

The boiler for heating the office and the bulk oil storage in the warehouse is in a corner of the warehouse, farthest from the tank yard, but separated from the building by a solid concrete wall 12 inches thick and a six inch concrete roof. The only entrance to the boiler room and coal bin is from the street at the front of the building.

The Rockford bulk plant serves a city of 100,000 population which has 392 industrial plants. A large stock of lubricants is carried in bulk and in packages. In addition to serving the city this bulk plant carries special lubricants and refined oils for which there is a call from the small bulk plants in surrounding towns.

H. H. Bogardus is the agent at the Rockford plant.

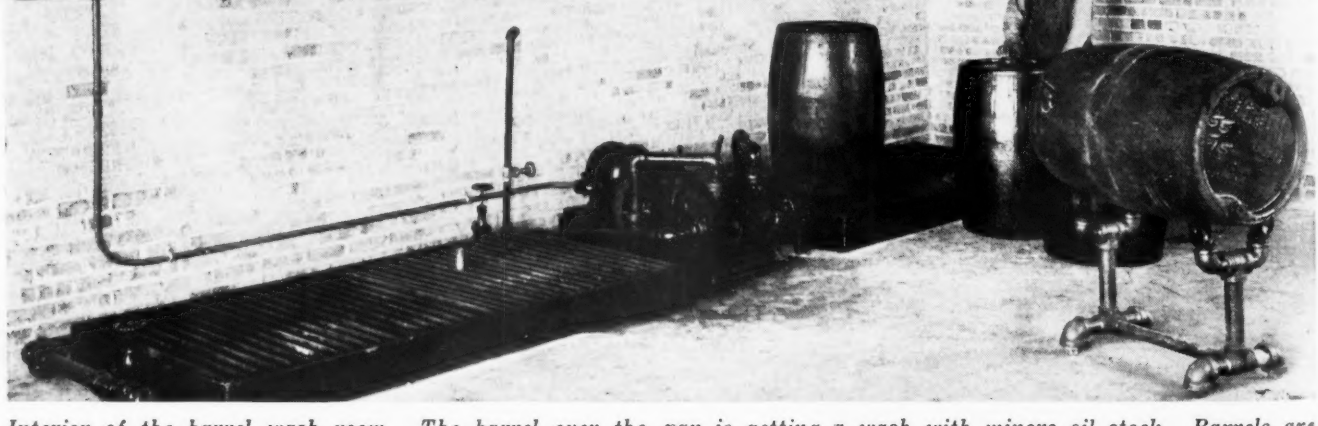
The plant is rectangular, about 200 feet across the street front, and about 286 feet along the long side. The railroad switch cuts across the back end and up the far side of the plant. At the front of the grounds on one side is the new warehouse for storage of package goods, bulk oils and a barrel cleaning and filling department. Opposite is the garage. To the back is the tank yard with the truck loading rack adjoining, and the refined oil pump house. The center of the grounds is covered with concrete drives.

The warehouse is one story high with a basement. Across the front is the office, and the boiler plant has been chiseled out of one corner. Back of the office is a package goods store room with a platform for unloading freight cars on one side and a truck loading platform on the other. An elevator in this room hauls to the basement.

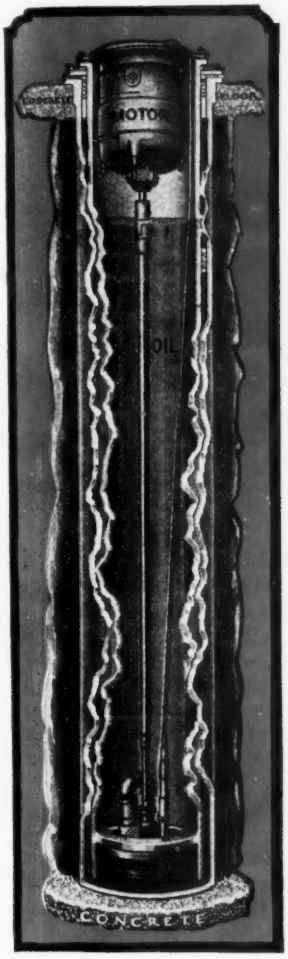
Back of the package goods store room is the bulk oil storage and barrel filling room, the last room is for barrel cleaning. To the rear of the building is a concrete platform for storage of barreled aviation gasoline as required by state law.

Bulk lubricating oil is stored in three 20,000-gallon and twelve 100-gallon tanks. The 20,000-gallon tanks are overhead on concrete cradles. These are in four compartments each, storing 12 grades of oil.

Tank cars of lubricating oils are



Interior of the barrel wash room. The barrel over the pan is getting a wash with minors oil stock. Barrels are rinsed on the pan to the left. On the right is the holder on which barrels are placed when painted



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6 Types

2 Oildraulic types (Free Wheel and Drive-on), plus 2 Airdraulic (air driven) types, Free Wheel and Drive-on, Oildraulic Bus and Truck Types 1 and 2.

Oildraulic Revolving Lift

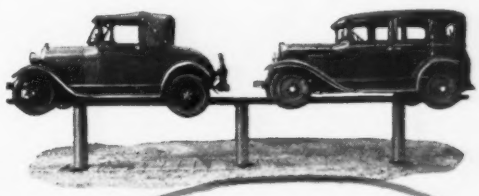
Reg. Trade Mark

Now "Heavy-Duty" Double-Duty Types

SOUND engineering design, installation and operating economies, in both free wheel and drive-on types, have made the OILDRAULIC the outstanding lifting device for showmanship in selling one-stop service, at minimum cost.

Now this same celebrated, unique principle has been extended to heavy duty needs . . buses and trucks . . the operators of which have been forced to accept the archaic, costly methods of oiling, greasing and conditioning, until now.

THE development of OILDRAULIC BUS AND TRUCK TYPES 1 and 2, offers more than Heavy Duty capacity in one-stop stations. It means "double-duty" flexibility in every arm of profitable service . . smooth-flowing output at "peak periods" . . maximum return on valuable space and equipment capital. Write for full details on these epoch-making new OILDRAULIC types.



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Send, without obligation, full information on OILDRAULIC LIFTS.

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Town _____ State _____

The truck loading rack. Note the theft device on the lines, a rod passing through loops on the caps and locked

unloaded from underneath. There are two spots on the siding. Inside the building are two pump batteries, each of four rotary pumps operated by a 10-horsepower motor. These pumps move 135 gallons of oil a minute. All lines in the lubricating oil bulk storage are 2½ inches in diameter.

The oil flows to the 12 barrel fillers by gravity. The fillers are automatic. A workman can be filling a number of barrels at the same time, and, when a barrel is filled, the liquid in the nozzle throws the trip, shutting off the flow. At the end of each fill line is a faucet for putting oil in containers smaller than a barrel. A barrel is filled in about 2½ minutes.

Tanks are gauged by means of a steel tape on the side of the wall, graduated in inches. These tapes, one for each compartment, move up or down with a float in the tank. Contents of the tank are computed from tables showing the capacity of the tank for each foot and inch as shown on the tape.

Along the side of the wall in the bulk oil storage room are twelve 100-gallon tanks for oils sold in smaller quantities. A monorail system is to be installed for emptying barreled oil into the tanks. On another side of the room is a metal trough for washing small oil containers. The washing fluid drains to a drum in the basement.

Each compartment in the overhead storage tanks, and all lines are stencilled with the name of the grade of oil it contains.

Barrels are washed and painted in the room back of the lubricating oil storage. Washing is done on two pans, each 3½ by 7 feet by 7 inches deep, with miners oil stock. Bungs are placed over a spout and a washing fluid is sprayed in. There are two rotary pumps, both operated by a three-horsepower motor. There is one pump for each tank, the fluid being drawn off the bottom and sprayed into the barrel.

After washing the barrel is placed over a spout in the second tank, containing miners oil stock also, for a rinse. Barrels are left on each pan for several minutes, and vacuum dried. The barrels then are examined with a bung hole light.

Painting is done on a home-made rack of short pipe lengths, fittings and four casters. The barrels are placed on side, and rolled around as painted. Color schemes are used to distinguish the various oil grades—Iso-Vis motor oil barrels are painted red and blue, Polarine motor oil barrels gray and red, and industrial oil barrels brown.

All barrels are cleaned and painted on entering the plant. After painting they are weighed and the tare weight chalked on the barrel head. After filling the gross weight is taken. The quantity in gallons, date of filling, and grade of oil are marked on the head. The refinery notifies the plant of the gravity of all oil shipped, and tables show the number of gallons of each gravity oil by weight.

Filled oil barrels, package grease, candles, wax, and alcohol are stored in the basement. The front room contains the barreled oil, the middle room package grease, candles and wax. In the back room is the barreled alcohol. Small service station supplies, such as light bulbs, brooms and soap, and truck tires, are stored in a room partitioned from the barreled oil storage space.

Packaged goods on the first floor, and barreled goods in the basement are stored in orderly rows, according to the company's code number for each product. Aisles are clean of rubbish and debris. Goods can be reached without disturbing any other commodities. Inventory taking is speeded up as everything is in order.

Barrels have bungs all in the same direction, and all are marked as to date of filling, contents, and type of oil. Whenever new goods are moved into the storage rooms they are placed on the bottom of the pile or at the back in order to get the older goods moved out first.

On the warehouse roof is the regulation marking for aviators. The name Rockford is spelled out in letters six feet high, and the name extends 40 feet across the roof. Arrows indicate the direction north, and the airport seven miles away.

The old office building, at the front of the grounds opposite the new warehouse, is used for locker space for workmen. Warehouses are of red brick, with flat roofs.

Refined oils are kept at the back of the plant. The railroad siding of about 500 feet extends along the far side of the new warehouse, and cuts across the corner of the refined storage space.

There are three spots for unloading refined oil tank cars. The racks are set in concrete bases with two three-inch pipe supports joined at the top to hold the unloading lines. Two lines lead from each spot to the pump house. After unloading overhead the tank cars are drained.

The pump house is of sheet iron, 12 feet square, with eight rotary pumps. Each battery of four pumps has a motor, pumps are rated at 135 gallons per minute.

An accompanying illustration shows the tank layout in the yard. Three inch lines are used throughout the refined oil storage, excepting the 1½ inch lines at the loading rack for filling small containers.

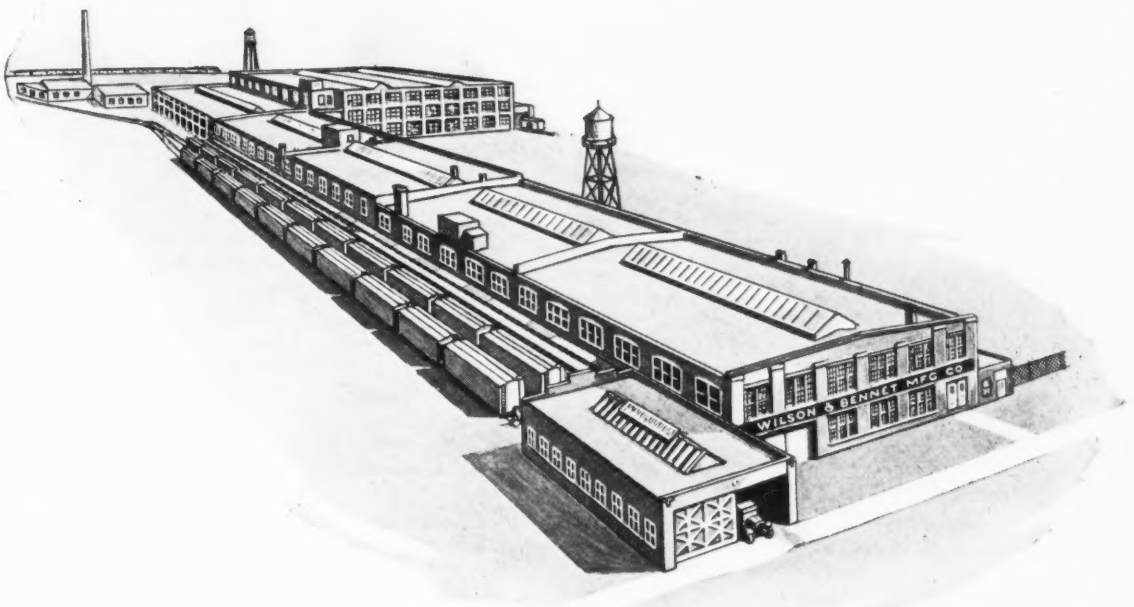
The only pump manifolded is that for burner oil. Storage for burner oil is in a 112,000-gallon upright tank. Oil is pumped from this storage to an

BENETCO STEEL DRUMS

180,000 square feet devoted to the manufacture of the BENETCO steel shipping drums

. . . . the nation's response to a quarter of a century of unexcelled experience and service.

home of the "Steel Container Specialists"



From an actual drawing of the offices and factory of Wilson & Bennett Mfg. Co.

WILSON & BENNETT MFG. CO.

"Steel Container Specialists"

6520 S. Menard Ave.
CHICAGO

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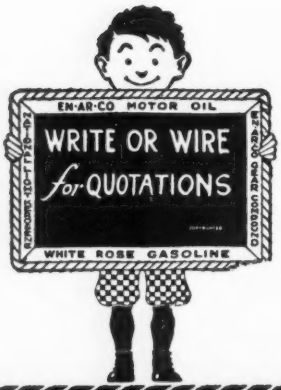

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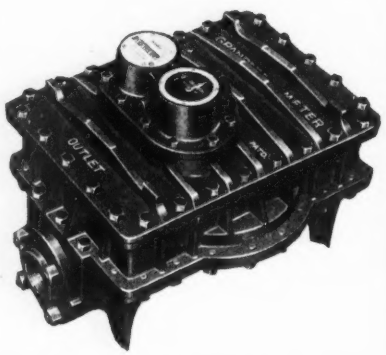

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is designed for use in all branches of the petroleum industry where the accurate measurement of petroleum is required.

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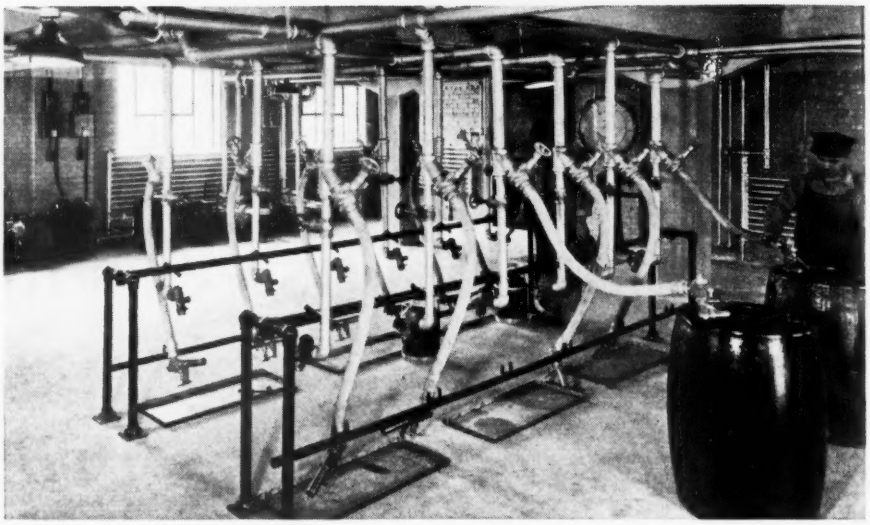


Interior of the lubricating oil storage and barrel filling room. Storage tanks are overhead. At the back are the eight pumps for unloading tank cars

overhead 3000-gallon tank for gravity loading of tank trucks.

In the old tank yard there was an assortment of tanks, horizontal, near the ground. Refined oils had to be pumped to overhead tanks from the storage tanks for gravity truck loading.

A uniform arrangement has been made of tanks in the new yard, and all tanks are overhead on concrete cradles above truck level, eliminating one movement of goods over the old arrangement.

The tank yard has a concrete dike 12 inches thick by 7 feet high. All grass is kept out of the yard as well as rubbish. Iron ladders lead from the ground to the runways over the tanks.

Trucks are loaded at the rack adjoining the tank yard. In fact the dike forms one of the concrete platforms. The rack has steel supports and a sheet iron roof.

Three trucks can be loaded at once. There are 22 outlets from storage tanks. Flow of goods from the outlet lines is controlled by the driver with a shut-off valve at the end of the line under the roof. A sheet iron funnel is used to connect the line with the tank truck. A 1500-gallon truck is filled in about 10 to 12 minutes.

Each morning the workman at the tank yard opens outlet valves at all tanks to be used that day. He also places the weights on the flow valves which shut off by the rope burning in the case of fire.

When the driver pulls into the rack his first duty is to ground his truck. In addition to the drag chain there is a clamp fitting over the knob on top of the tank. The clamp is on a pulley and is grounded to the street frame, which extends three feet in the earth. All storage tanks in the yard are grounded to three feet also.

All trucks are gauged on entering and on leaving the plant by an office employee. To save time of returning to the rack on under or overloading a truck, containers are kept in the front of the warehouse for excess liquids.

PONTIAC, Mich.—Eight special new chassis type heavier duty trucks are now available of the General Motors truck model T-60. The new types are known as T-60 Specials and have capacities ranging up to 22,000 pounds.

Heavier worm-drive rear axles, two-stage rear springs and larger tires contribute to the increased capacity of the new trucks, the company says.

The company also has placed on the market a new deluxe nine-foot panel body for light duty in its model T-19 chassis with 133½-inch wheelbase. The addition of its extra-length body answers the demand among truck operators for a factory built body with greater loading space for handling large, bulky loads.

One Pump Gallonage Records?

PHILADELPHIA.—An exceptional record of gasoline sales through a single 10-gallon hand-operated pump is reported by a Sun Oil Co. dealer in Camden, N. J. This pump sold 23,604 gallons during last August, or an average of 800 gallons each day.

Another dealer of that company in Toronto sold 32,513 gallons in one month through a single pump, or more than 1000 gallons per day.

Michigan Jobbers To Convene

JACKSON, Mich., Oct. 26.—The annual convention and equipment exhibit of the Michigan Oil Men's Association will be held at the Statler Hotel, Detroit, March 19, 20 and 21, according to H. H. Ragle, president.

Drums May be Reconditioned at Low Cost and Be as Good as New

By Roger B. Stafford
N. P. N. STAFF WRITER

COMPANIES that specialize in selling lubricating oils to the industrial, farm or dealer trade in drums, have found keeping their drums cleaned and painted to be a profitable practice. Reconditioning costs are low and the salvaged drums are often just as good as new.

Cleaning, of course, is the most important and the most difficult step in salvaging used barrels.

Soaking the drums in a caustic solution and then rinsing them in water and drying, is the accepted method of cleaning the outside of old paint, oil or grease.

There are several methods in use for cleaning the drums on the inside but two seem to be in more widespread use among oil companies. These methods are washing with a caustic solution by agitating the drum or barrel, and steaming them. Oil men who have used both methods, advocate the washing.

Before washing, foreign matter should be withdrawn from the barrel, the best means being a suction tube. The drum may then be partly filled with a hot caustic solution, such as Oakite, Enamel Remover, or trisodium phosphate and caustic soda.

The drum must then be agitated. There are two usual methods of agitation. One is to roll the barrel, usually through a soaking tank in which instance the outside is cleansed at the same time.

The other method is to attach two or more drums to a machine that will whirl them end over end until the inside walls of the drum are cleared of all oil, grit and rust.

The caustic solution may then be drained, and the grit, rust and remaining moisture may be withdrawn with a suction tube.

A system used by the Nourse Oil Co. of Kansas City has been described by that company as follows:

"The equipment necessary to make up our cleaning process is an Arco Wand truck vacuum cleaner, a 60-gallon grease barrel with a large open head, a 1500-gallon rectangular tank with our own designed barrel washer in one end, and a small rinsing tank, which is used to rinse the outside of the barrels off after they have gone through the cleaner, and an electric extension with a candle globe on it that will drop through the large bung of any of the different size barrels.

"All of our barrels are returnable from our customers; therefore, there is more or less sediment, sand, rust, sticks, and rocks coming back in them, and the only possible way to get these foreign substances out of the barrel is by pulling it out with a vacuum cleaner. It is impossible to get it out by steaming, because this will all settle around the edge of the barrel and there is not enough moisture in the steam to wash it out over the bulging 2-inch opening.

"We remove the large bung, place the head of the barrel in a sloping position by leaning it on a 2-by-4, which compels all of the sediment to drain in one corner of the chime; then the vacuum cleaner is inserted through the 2-inch opening and all of the foreign substance pulled out.

"Then the barrel is taken to the 60-gallon grease barrel, which contains a solution made from water, trisodium phosphate and caustic soda. This solution is kept at a boiling point by means of raw steam running into the barrel. We put about three gallons of this solution into the barrel and screw the bung in tight, and then the barrel is rolled back and forth on first one end and then the other several times, giving the solution a chance to heat up any of the heavy oil sticking to the sides and ends of the barrel.

"Then the barrel is put into the 1500-gallon tank, which contains the same kind of solution that the 60-gallon barrel has. This tank is large enough to accommodate about six 50-gallon barrels, and when the men have that many barrels in the tank, they go to the other end where the barrel cleaner is and commence running the barrel through this cleaner, which lets the barrel rest in this boiling solution. As it revolves, the boiling solution on the inside of the barrel and the solution on the outside thoroughly melts all of the grease and oil in the barrel and on the outside, and at the same time, will remove all the old paint that

—Photo by Perfection Mfg. Co.

One type of suction cleaner for oil drums. This outfit may be stationary or it may be mounted on a low truck

has been applied for the last three or four years.

"It only takes a few seconds to do this—then the barrel is taken out and put in the rinsing tank, which is close by, rolled over a time or two, and is then taken a few feet away to the vacuum cleaner, and again the barrel is set in a sloping position, so that this hot solution will settle in one corner of the chime, taking with it all of the sediment, rust and foreign substances that we were unable to get with our first pumping.

"We might say in passing, that this last treatment will show the men all leakers, because this hot solution in a cold barrel will form a pressure equal to two or three pounds and in so doing, will force the solution on the inside of the barrel out through any small opening that might have been caused during transit, and in that way, saves a separate attempt at finding leaky barrels. If the barrel is sound and solid, the bung will almost jump out of the workman's hands, when he unscrews it after it has gone through our processes.

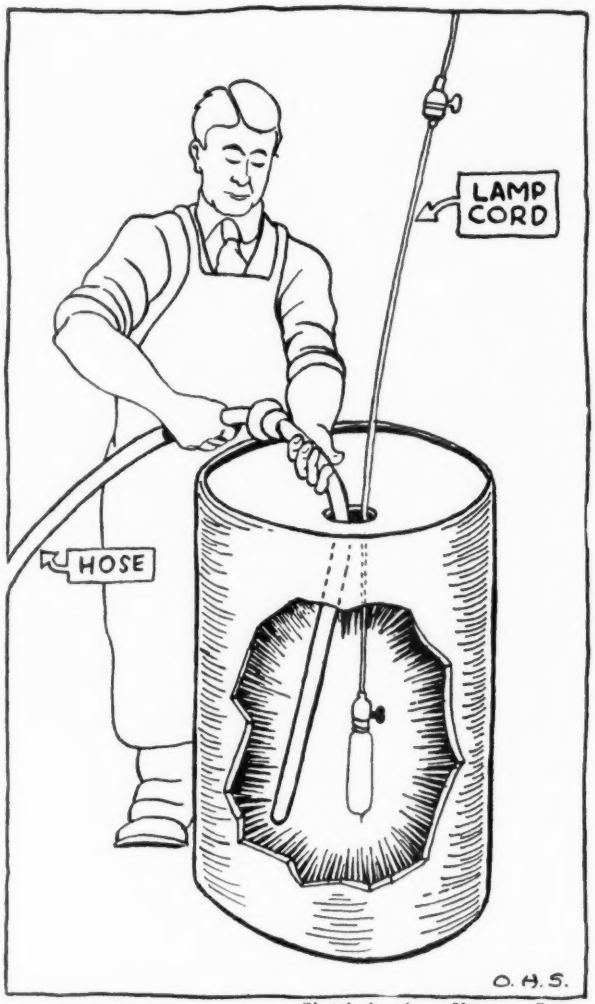
"After the last pumping has taken place, our barrels are then given to the painter and after they have been painted, we roll them to one side and put them in a sloping position on 2-by-4's once more and each day's painting is permitted to stay in this position until the next morning.

"Then all bungs are removed again and electric extension inserted, giving the workman an opportunity to see the barrel on the inside as plainly and clearly as they can on the outside. If we have failed to take out all of the solution which we put in, it will have settled in the chime by this time and again we pull our vacuum cleaner up and pull out the very last drop that is left in the container. We do not have to do this very often, because the intense heat that this barrel has accumulated while going through the solution automatically dries itself, or runs all of the water to the bottom of the barrel.

"While the workmen are inspecting the inside of the barrel, they grade our barrels into two classes—No. 1 and No. 2. Our No. 1 barrels are the ones in perfect condition, and which are used for motor and tractor oils. No. 2 barrels are used for harness oil, black oil and, in fact, all oils that do not go into motors, and this class of barrels includes the ones that are rusty on the inside and something that would discolor or make a grit in a motor oil.

"After these inspections have taken place, the bungs are replaced in the barrels and then they are taken to our ready-for-use storage.

"Our cost per barrel, including all materials used, and labor, amounts to .163 per barrel, and I assure you that when we put our O.K. on a barrel."



—Sketch by Arco Vacuum Corp.

This is the way a candle type electric lamp is used to inspect the inside of a drum for cleaning with a suction tube

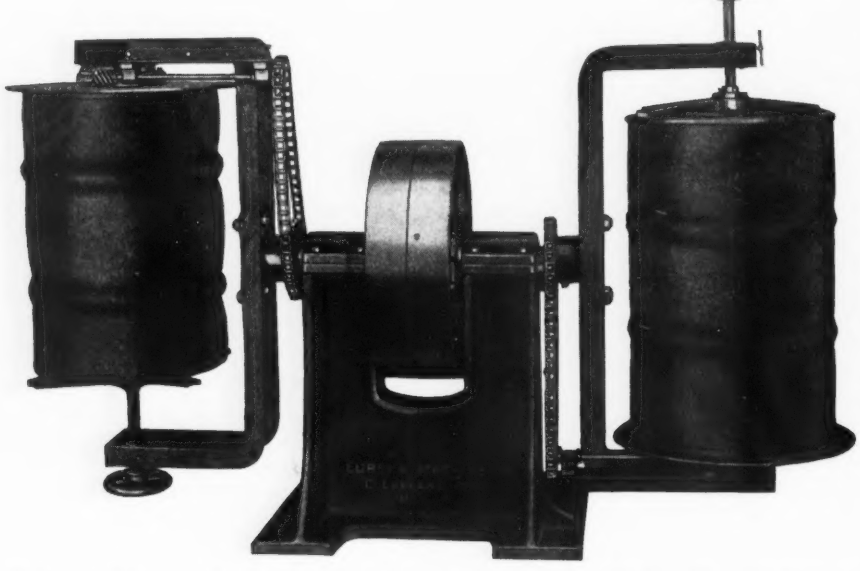
It also is possible to remove all moisture by putting alcohol into the drum and revolving it a few seconds. A suction pumper may be used to remove all the alcohol possible and then a hot blast may be blown through the drum or the drum placed for a short time in a hot drying room.

With drums that are in good shape and which may be used for the same oils that had been in them, a light oil or kerosene may be sprayed on the inside, and allowed to drain to the bottom. The solvent may be withdrawn with a suction tube.

Holes in drums or steel barrels may be easily patched by an electric or acetylene welder.

After drums come from a soaking tank and rinse, they usually are hot enough to dry on the outside. Rust, scale and remaining paint on the outside can be removed with a wire brush. The barrels are then ready for painting.

There are barrel cleaning and painting plants in many of the larger cities but their charges run $1 to $2 per barrel as compared with 16.3 cents per barrel of the Nourse Oil Co.



This machine, made by the Eureka Machine Co., agitates the solution in two drums or barrels simultaneously by whirling the drums end over end and rotating them at the same time

New Stations Building

Note: Material used in this column is principally taken from the newspapers. NATIONAL PETROLEUM NEWS assumes no responsibility for its accuracy.

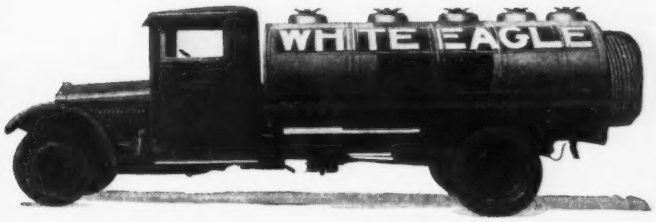
The list as published from week to week cannot be looked upon as indicative of the relative extent to which stations are being built in various parts of the country.

Yankton, S. D.—G. A. Steinback, filling station.
St. Cloud, Minn.—Nich Brauch, filling station.
Monroe, Wis.—Mid-Continent Petroleum Corp., filling station.
Billings, Mont.—The Texas Co., filling station.
Chanute, Kans.—Shell Petroleum Corp., filling station.
Palmer, Kans.—Clarence Thompson, filling station.
Rosebud, Tex.—Paul Reichert, filling station.
Ottawa, Kans.—Taylor Oil Co., filling station.
Mound City, Mo.—Shell Petroleum Corp., distributing plant.
Kansas City, Mo.—White Eagle Oil & Refining Co., filling station.
Parkersburg, Ia.—Thole Cramer, Jr., & William Huisman, filling station.
De Smet, S. D.—White Eagle Oil & Refining Co., filling station.
Waterloo, Ia.—Mid-Continent Petroleum Corp., filling station.
Chester, Ill.—Harry Katz, filling station.
Cumberland, O.—Chas. Combs, filling station.
Terre Haute, Ind.—Standard Oil Co., filling station.
Bremen, Ind.—Oscar Mutti, filling station.
Covington, Tenn.—Tennessee Oil Co., filling station.
Wauseon, O.—Ohio Hi-Speed Oil Co., filling station.
Monticello, Ill.—Shell Petroleum Corp., filling station.
Kenton, O.—Hardin County Oil Co., service station.
Mansfield, O.—The Texas Co., filling station.
Cincinnati, O.—The Texas Co., two filling stations.
Piqua, O.—Lee Louis, filling station.
Carroll, Ia.—McCullough & Beiter, filling station.
McLaughlin, S. D.—C. H. Martin, service station.
La Crosse, Wis.—Hayes Estate, filling station.
Minneapolis, Minn.—Standard Oil Co., service station.
Minneapolis, Minn.—Martin R. Knutson, service station.
Waterloo, Ia.—Standard Oil Co. filling station.
Livingston, Mont.—J. J. Wiggins and E. T. Lake, filling station.
Spencer, Ia.—Mid-Continent Petroleum Corp., filling station.
Ottumwa, Ia.—George Miller, filling station.
Fort Dodge, Ia.—Shell Petroleum Corp., St. Louis, filling station.
La Verne, Okla.—Phillips Petroleum Co., warehouse and filling station.
Kansas City, Mo.—Standard Oil Co., filling station.
Columbus, O.—Standard Oil Co,, filling station.
Pueblo, Colo.—Richfield Oil Co., bulk station.
Terrell, Tex.—Cities Service Oil Co., filling station.
Augusta, Kan.—Phillips Petroleum Co., filling station.
Iowa City, Ia.—Mid-Continent Petroleum Co., filling station.
Harrodsburg, Ky.—Standard Oil Co., service station.
New Lexington, O.—Standard Oil Co., filling station.
Cleveland, O.—Joseph Sands, filling station.
Toledo, O.—Fred Ehrle, filling station.
Beardstown, Ill.—Ratcliffe & Dawson, filling station.
Asheville, N. C.—Standard Oil Co., filling station.
Savannah, Ga.—Shell Petroleum Corp., bulk station.
Tampa, Fla.—Pan-American Petroleum Corp., service station.
Richmond, Va.—Richmond Motor Co., service station.
Jacksonville, Fla.—Pan-American Petroleum Corp., service station.
Washington, D. C.—Penn Realty Corp., filling station.
Lufkin, Tex.—Humble Oil & Refining Co., filling station.
Kansas City, Mo.—Firestone Tire & Rubber Co., master service station.
Charles City, Ia.—Mid-Continent Petroleum Corp., filling station.
Carmi, Ill.—Earnest Perkins, filling station.
Wheeling, W. Va.—John T. Carter, filling station.
Wilmington, N. C.—Standard Oil Co., filling station.

Only in COLUMBIAN TRUCK TANKS CAN YOU GET

PARTITION MOUNTING
3-POINT SUPPORT
INTEGRAL WELDING

PATENTS make the three cardinal features of Columbian truck tanks exclusive. Only a Columbian truck tank has partition mounting, which reduces deadweight and increases payload. Only a Columbian truck tank has 3-point support, which eliminates vibration and chassis strain. Only Columbian oil transportation units have integrally welded pipe-lines; bucket box and mounting all being joined together, thus adding years of service to every truck tank manufactured by this pioneer company. Order your oil marketing equipment from a company where mechanical genius has made leadership in its field a habit.



COLUMBIAN STEEL TANK COMPANY

EST'D 1894 TANKS FOR THE WORLD

1405-1625 W. 12th St. Kansas City, Mo.

BRANCHES: 30 Church St., New York; 408 Chamber of Commerce, Denver; 564 Market St., San Francisco.

DISTRIBUTORS: Herman Body Co., St. Louis; Truck Engineering Co., Cleveland; The Highland Body Mfg. Co., Cincinnati; Wm. Ford & Co., Detroit, Flint and Toledo; The Schnabel Co., Pittsburgh; Truck Equipment Co., Buffalo; Perrin Walsh Co., Boston; Interboro Hoist & Body Corp., Long Island City; Philadelphia Truck Equipment Co., Philadelphia; Maryland Truck Equipment Co., Baltimore and Washington; Dixie Culvert & Metal Co., Atlanta and Jacksonville; The Equipment Co., Nashville; Leland Truck Equipment Co., Tulsa and Dallas; San Antonio Body Co., San Antonio; California Columbian Steel Tank Co., Ltd., Los Angeles; Western Steel Products Co., Duluth; A. Y. McDonald Co., Omaha, Lincoln, Sioux City and Des Moines.

GREATER fluidity

Here is the ideal winter oil — no danger of the coldest weather interfering with your service — "New-Process" Oils flow easily (regardless of low temperatures) from tank car to tanks; tanks to drums; wagons to tanks; pump readily at stations — and perform PERFECTLY IN THE MOTOR —

For safety and convenience in handling, for absolute TRADE satisfaction—for greater profits—make your arrangements now for these superior WINTER OILS.

Single Compartment Cars — *Steel Barrels*

Two Compartment Cars — *Wood Barrels*

Three Compartment Cars

DEEPWATER OIL REFINERIES

HOUSTON, TEXAS

Refiners for Jobbers

Small Tools Accumulate at Stations, Standard Kit Not Available

CLEVELAND

SMALL tools for lubrication work at a service station, like the proverbial hash, seem to accumulate. Apparently the tool manufacturers have overlooked this field for bringing out a complete kit of small tools. A wide variety of small tools, from many manufacturers, and in all conditions of wear are found at most service stations.

Below is a list of small tools, aside from greasing equipment and adaptors, used at five lubrication stations in greater Cleveland. Most workmen have forgotten where the tools originated. Some tools were furnished by the company, while others were purchased by the workmen as needed from 5 and 10 cent and hardware stores.

All of the stations provided a bench, box, or shelf space for storing tools. At the outdoor pits of the Hickok Producing Co. station tools were kept in a wooden box about three feet high, with two doors, at the head of the space between the two pits. Tools were in order and grouped together; for instance, the five monkey wrenches were on the shelf arranged according to size. Some tools were hung from nails on the sides.

At the three indoor pits of the Sinclair Refining Co. station tools were kept on shelves below the pits and on the ground level. Tools used mainly for underneath the car were on the lower shelf, while tools such as hub cap wrenches were stored on the shelf above the pits.

A set of tools generally was supplied for each two lifts or pits. At the lubrication station of the Standard Oil Co. of Ohio a set was assigned to two lifts. One set was provided for the work at the Sinclair station where there were three pits. At the Canfield Oil Co. station there was one set for two indoor connected pits. The station of The Texas Co. had one outdoor rack.

Petty thefts and carelessness are to be guarded against with small tools around lifts or pits. Customers or workmen might carry off the smaller tools, and tools also might be left on running boards through the workman's carelessness.

To guard against the loss of small tools the Standard Oil station checks up on each shift. Workmen carry the smaller tools and turn them in when leaving. The foreman turns over the tools to the incoming foreman who in turn issues them to his men. The check is made to guard against petty thefts and carelessness.

BUTLER, Pa., Oct. 25.—Myron Evans, formerly with the Island Petroleum Co., Pittsburgh, is refinery sales manager for the Valvoline Oil Co. here.

OAKLAND, Calif.—E. A. Ponder, Ponder Bros., Inc., Tacoma, Wash., distributor of line of S. T. Johnson Co. oil burners, was a recent visitor at the factory of the Johnson company at Oakland.

Small Tools Used at Five Stations in Cleveland

Hickok Producing Co.

One 8-inch Ajax wrench for water pumps.
Five monkey wrenches, from 6 to 14 inches.
One ¼-inch open end wrench.
One small pipe wrench.
One Excel socket wrench, with several pieces of stock.
One socket wrench set, with nine adaptors.
Two 12-inch L double lever.
Two L levers especially for Hudson, and Essex clutches.
Two Crescent wrenches, six and eight inches.
Two 3-foot crow bars.
One 2-foot crow bar.
One pair small pliers.
Four 12-inch screw drivers.
Two wire brushes for springs.
Fourteen hub cap wrenches.
For hub caps not removed with these wrenches, a pipe wrench with a cloth around the cap is used.

Standard Oil Co. of Ohio

One 12-inch Excel wrench with two pieces of stock.
One 8-inch screw driver.
One 12-inch screw driver.
One 8-inch offset screw driver.
One-pound hammer.
One ½ pint flexible spout oil can.
One 30-inch pinch bar.
One 6-inch Crescent wrench.
One 8-inch Crescent wrench.
One 12-inch Crescent wrench.
One 18-inch all steel monkey wrench for removing hub caps.
One small pair pliers.

Canfield Oil Co.

One set of socket wrenches.
One 6-inch Crescent wrench.
One 10-inch Crescent wrench.
One 12-inch Crescent wrench.
One 12-inch Stillson wrench.
One common monkey wrench.
One 8-inch screw driver.
One 12-inch screw driver.
One set ⅜-inch Hudson, Essex female wrench for clutch.
Several small pliers.
Assortment of hub cap wrenches.

Sinclair Refining Co.

One 12-inch Excel wrench.
One small wire brush for springs.
One ball headed hammer.
One 12-inch monkey wrench.
Two 14-inch pipe wrenches.
Two claw hammers.
One 12-inch pipe wrench.
One 10-inch Crescent wrench.
One small pair pliers.
Two Bingo wrenches for hub caps.
Four hub cap wrenches for more popular cars.
One 24-inch pinch bar.

The Texas Co.

Two hub cap wrenches, one for Ford, one for Chevrolet.
One 8-inch screw driver.
One 12-inch screw driver.
One claw hammer.
One 12-inch monkey wrench.
One 24-inch pinch bar.
One large pipe wrench.
One 8-inch master wrench.
One adjustable wrench for female plugs on crank cases or rear ends.

Greasing

34 articles in National Petroleum News, published since the first of 1928, have been devoted exclusively to telling how to grease cars properly and profitably How to build greasing stations, how successful companies sell their grease, and other grease problems, are also discussed in these stories.

Here they are for your file reference:

1929

Grease making, past and present Oct. 16, p. 67
Tests of lubricating greases Oct. 16, p. 69
Grease neglected, chemists say Sept. 18, p. 33
Eight pointers on how to build up grease sales Aug. 28, p. 100
Encloses grease pits for winter profits Aug. 7, p. 101
How Omaha Ford dealers go after greasing July 24, p. 82
Grease equipment specifications adopted by Conference of Weights and Measures June 26, p. 96
Grease is future auto engine lubricant June 26, p. 138
Grease pump code amended to permit sales by weight June 12, p. 41
Grease gun specifications to come up June 6 May 29, p. 32-D
Non-metering grease pumps may be ruled out May 22, p. 38
How jobbers can help greasing sales May 22, p. 120
Grease stations may have to get new equipment May 15, p. 32
Puts out grease chart for every car May 15, p. 143
Takes lubrication to farm trade Apr. 24, p. 104
Handbook on chassis greasing Apr. 17, p. 110
Open air greasing stations in California Apr. 10, p. 92
Thoro lubrication for car—what to grease March 20, p. 178
Gives men grease sale profits March 20, p. 184
I. O. M. A. lubrication chart March 6, p. 94
Boosts grease sales with parades, radio Feb. 27, p. 98
Speed, thoroness in lubritorium Feb. 13, p. 96
Car greasing profits lost at most stations Jan. 30, p. 75
Something about auto greases Jan. 30, p. 76
Grease pit housed in style Jan. 23, p. 72
Selling industrial greases Jan. 16, p. 87

1928

Station sells 7500 lbs. grease in one season Oct. 31, p. 32
Proper greasing of cars brings profits Aug. 22, p. 71
Grease salesman tells how to sell it July 18, p. 81
Chassis greasing profits hardly scratched June 13, p. 21
Greasing success means good merchandising May 30, p. 53
How car lubrication adds to profits May 23, p. 19
Grease station designed after year's travel May 16, p. 25
Keeping steady customers at grease stations Feb. 1, p. 29

Back copies of any of the above issues are 25c a copy. On issues that are exhausted, photostats will be furnished at 40c per page. Libraries in the larger cities generally keep back files of National Petroleum News complete.

National Petroleum News
Main Office: 1213 West Third St.
Cleveland, Ohio

Lube Specialist Picks Oil He'll Sell Only After Road Tests

CLEVELAND, Oct. 25

R. H. BLACKBURN of Spartansburg, S. C., who specializes in automobile lubrication some time ago sent out a form letter to motor car owners of his community telling of tests that led him to sell the oils he sells. Here is the way Mr. Blackburn describes the tests:

"A few months ago, I sent a man up the street with new, clean 5-gallon cans, with instructions to buy two (2) gallons of every kind of 'HEAVY' oil on the market, which was systematically carried out. I then purchased a new Model T Ford motor, had it installed in a Ford touring car, had motor broken in very carefully, with hose running water into radiator.

"Then five (5) quarts of oil from some brand purchased was put into crankcase, and the car was driven to Gaffney, S. C., (a distance of 20.2 miles—40.4 miles round trip) and return 12 times and 7½ miles out and return on the thirteenth trip, which made a total of 500 miles on each sample of oil. Driver was allowed one (1) hour and fifteen (15) minutes to make the trip to Gaffney and return, with 5 to 10 minutes rest time at Spartanburg to look after motor, see if any oil, water or gasoline needed, etc.

"After the 500 miles was driven, the oil remaining in the crankcase was drained into one-gallon, clean, clear glass bottles, and labelled, and noted for quantity recovered, whether any oil had to be added during the driving, and quality of the oil after having been driven 500 miles at 35 miles per hour, over the same road. (All tests on all samples over the same road.)"

Mr. Blackburn then explained that only three oils stood up the same and one made such an excellent showing that he engaged to sell it although it was little known around Spartanburg. He said the oil was made of Pennsylvania crude oil by a special refining process and concluded with a request that the oil be given a trial the next time the car owner changed oil.

Twenty-five road tests of 500 miles each were run in which 720 gallons of gasoline were used in driving 12,500 miles, an average of a little more than 17 miles per gallon. In the test a new Model T Ford engine was used in an old Ford touring car.

Merco Nordstrom Valve Co., San Francisco, reports having received several hundred replies in its slogan contest for the most suitable slogan for its valve. Anyone is eligible to send as many slogans as they wish. Cash prizes totaling $500 are being offered for the best slogans submitted.

The much sung beach of Waikiki is not the only attraction in Honolulu. Here is a super service station operated by V. J. Burgess and three added attractions gowned in latest Hawaiian fashion. The picture was sent in by S. F. Bowser & Co., Inc., whose gasoline and oil dispensing equipment is used

Merchandising Talks

A Few Ideas of How Successful Merchants Move Their Goods

By Roger B. Stafford
N. P. N. STAFF WRITER

THE efficiency of good displays in selling merchandise is shown by a test made by the International Advertising Association which is reported in *Domestic Commerce*, a publication of the U. S. Bureau of Foreign and Domestic Commerce.

A drug store substituted simple drapes for the usual display of miscellaneous merchandise. Sales fell off and it was estimated that the loss during the test period amounted to $3000. Percentage declines in sales in various departments were estimated as follows: Specialties 41 per cent; candy 32 per cent; rubber goods 22 per cent; toilet goods 18 per cent; soda 14 per cent; stationery 10 per cent, and prescriptions 2 per cent.

Every gasoline and oil service station contains one or more windows which can be used effectively to sell some merchandise the oil company has. It may be a pound can of cup grease, an emergency can of motor oil, a half-gallon emergency can of gasoline, or the numerous small necessities of automobiles such as spark plugs, tire repair kits, sets of bulbs in tin boxes, and such.

These things should not require a great deal of time in selling so motor traffic could still be expedited through the station.

* * *

Shell Petroleum Corp. recently advertised in large newspaper space several of its specialties which are sold at drug stores, cigar stores, and other places than the company's own stations. The specialties were: Lighter fluid; dry cleaner furniture polish, and handy oil, a household lubricant. The company does not handle these products at its own stations.

* * *

"HOW much should I spend on advertising and how?" is a question many managers of marketing companies have probably asked themselves when they begin to figure their budgets. There is no set rule of how much should be spent but the system of one successful operator of a chain of service stations in a middle western city may serve as a guide to other marketers.

This particular company's advertising has been good. It might be described with that common expression, "It stands up and barks."

This company bases its advertising expenditure in any year on its gross profits in the preceding year. Its gross profits are determined merely by subtracting what it paid for its merchandise from what it sold it at. Its appropriation is 8 per cent of the gross and the sum breaks down to about ⅜-cent a gallon on gasoline, 3 cents a gallon on motor oil, and 2 cents a pound on grease.

Taking its appropriation at 100 per cent, it spends 30 per cent on outdoor advertising, 20½ per cent in newspapers, 24 per cent for radio, 10 per cent in local class magazines, 8 per cent in direct mail and pamphlets, and the remaining 7½ per cent on art work, engravings and other incidentals.

The sales manager of this company recently answered a question as to whether its advertising sold its goods with these words:

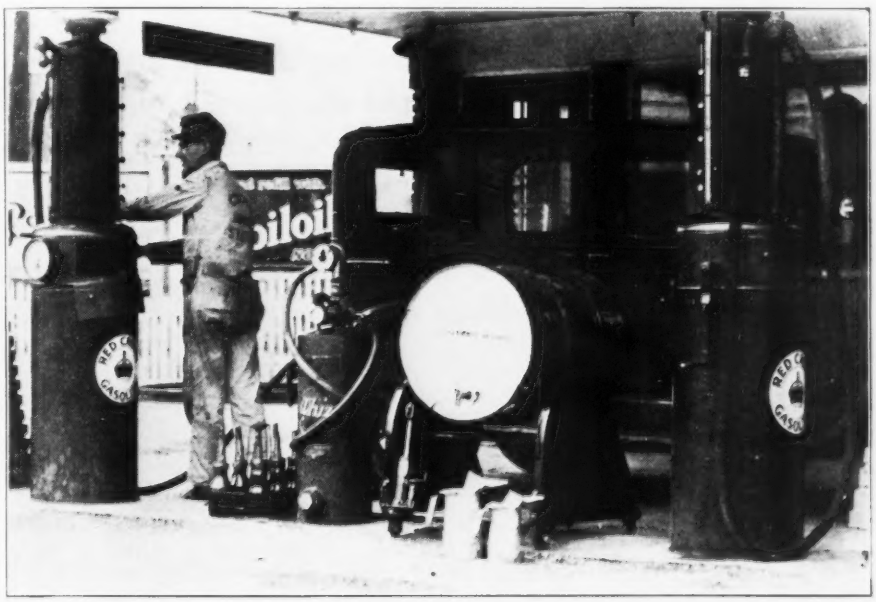
"Advertising may not sell merchandise but it makes selling easier for your employes."

This company has increased its gasoline and oil gallonage and most important of all, its profits, each successive year. And it has never cut a price.

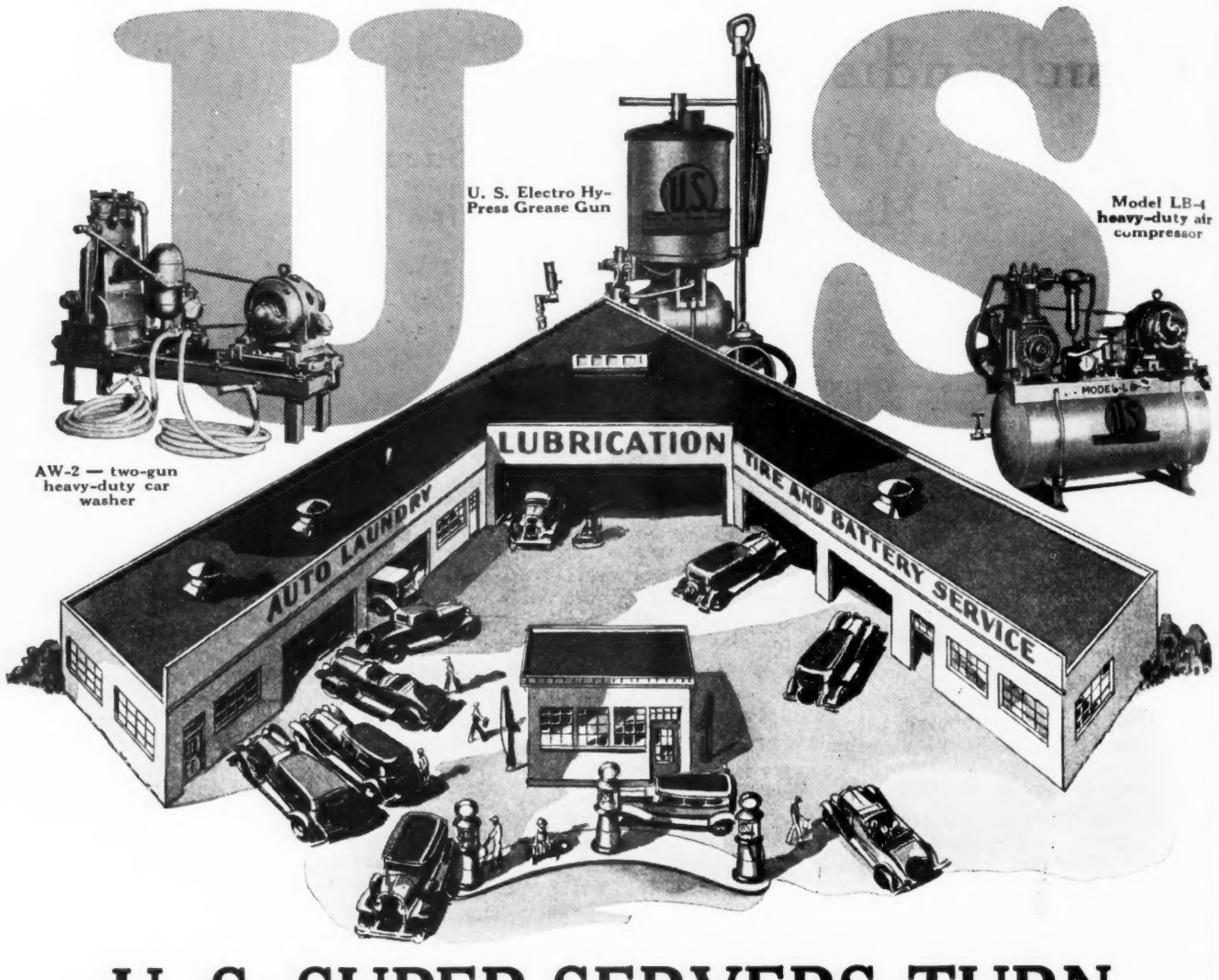
* * *

IT WILL soon be anti-freeze time over the northern half of the country and in some localities motorists are already adding a little alcohol or other anti-freeze agent to their radiator solutions. It's time for oil station operators to give some thought as to how they will handle their anti-freeze business this coming winter.

A good way is to keep the drum out where the motorist will see it. People like to see the goods they buy, even though it is only the outside of the container. There are several drum stands on the market which permit a drum of alcohol to be placed almost any place about the front of the station and to be taken into the station at closing time.



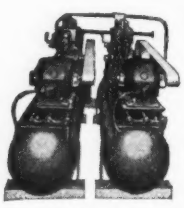
Drums of alcohol on pump island of Standard Oil Co. of Indiana service station. This particular drum rack, made by the Champion Corp., Hammond, Ind., has a hydraulic jack attachment which permits the drums to be tilted by one man to any angle


U. S. Electro Hy-Press Grease Gun
Model LB-4 heavy-duty air compressor
AW-2 — two-gun heavy-duty car washer
LUBRICATION
AUTO LAUNDRY
TIRE AND BATTERY SERVICE

U. S. SUPER-SERVERS TURN
Passing Motorists Into *Regular Customers*

A TANDEM hook-up of two big U. S. Air Compressors (see small illustration below) recently devised by the United States Air Compressor Company, for super-service stations, has attracted widespread attention among engineers in charge of marketing operations.

This remarkable installation provides volume air at high pressure for a variety of service work and insures unfailing and continuous operation. For should one air compressor be temporarily out of service — the other one, in tandem, can carry the load and maintain service.



Here is the tandem installation of two big U. S. LB-5 air compressors with automatic water valve. Either one can carry the load and service never fails.

Engineers in charge of marketing were among the first to realize that super-service equipment must not only be fast, efficient and economical, but absolutely dependable and able to meet the demands of rush hours and continuous operation. And they were among the first to recognize the superior dependability of U. S. Super-Servers to deliver the kind of service that turns passing motorists into regular customers.

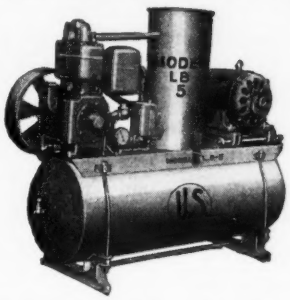
U.S. Super-Service EQUIPMENT

is Dependable, Efficient—Attractive Looking

Every one of the big family of U. S. Super-Servers are beautifully finished. As car owners watch operations of super-service with attractive looking U.S. Equipment, they receive an indelible impression of speed and efficiency that brings them back again and again.

Your request will bring expert information on U. S. Equipment as applied to your special needs.

U. S. AIR COMPRESSORS



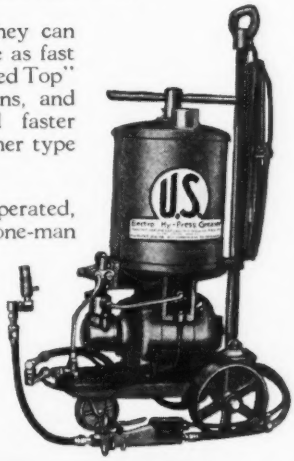
A Complete Line for Every Super-Service Requirement

U. S. Air Compressors range in capacity from 1½ to 20 cubic feet of air per minute. Model LB-5 shown above was designed after a study of the air requirements of hundreds of super-service stations and garages. This popular unit is a heavy-duty twin cylinder, water-cooled compressor equipped with Timken roller bearings. It will supply a steady volume of air in large quantities for tire inflation, paint spraying, spring oiling, engine cleaning, or for operating half-inch riveting or chipping hammer.

U. S. ELECTRO HY-PRESS GREASE GUN

Mechanics say they can grease a car twice as fast with the U. S. "Red Top" as with hand guns, and at least a third faster than with any other type of power greaser.

It is electrically operated, sturdy, portable one-man unit. "Pressure shot operation" saves grease and shoots lubricant through the most stubborn bearing.

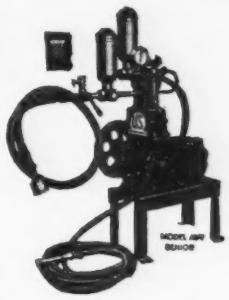


U. S. Perfect Balance Service Tower

Air, or combination air and water tower that is very popular with motorists and station operators. Has a revolving head—hose and air chuck, can't touch ground or lash.

U. S. CAR WASHING SYSTEMS

Successful wash rack operators say that the high pressure hydraulic method used in all U. S. car washers is superior to all others. U. S. Model AW-7 (shown here) is one of a family of one, two and four-gun units. It is ideal for an establishment washing 8 to 15 cars per day. Most quiet running washer ever designed. Special U. S. gun provides powerful cutting stream or soft penetrating mist with easy adjustment.



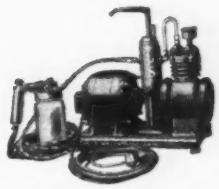
U. S. Model AW-7
Delivers six gallons of water per minute at 325 pounds pressure.

U. S. Engine Cleaner and Spring Sprayer

A valve controlled at the nozzle gives either a spray of oil or dry air for cleaning inaccessible places.

U. S. Spring Tank Oiler

Pistol grip gun with long curved nozzle, directs needle-like stream of oil to any spot—no oil wasted—no soiling of car.



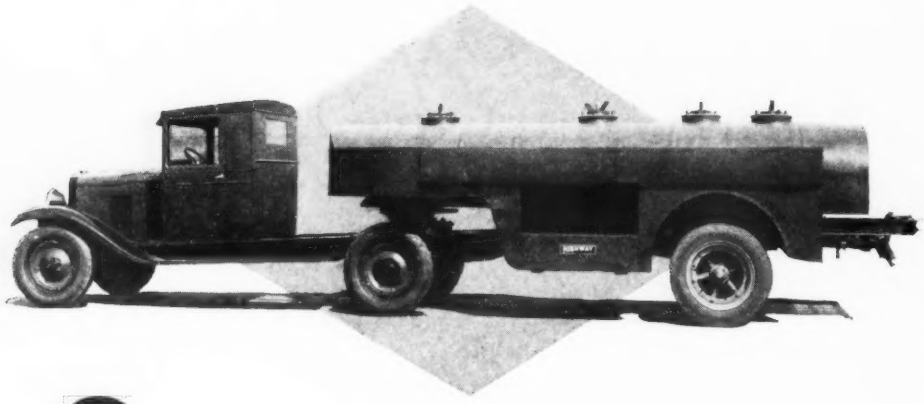
U. S. Spray-All Painter

A complete spray unit for all materials. Operated by sturdy air compressor instead of blower principle. Weight only 46 pounds—is portable and ready to plug in convenient light socket.

U.S. AIR COMPRESSOR COMPANY

5314 Harvard Ave. Cleveland, Ohio

Manufacturers of Air Compressors, Paint Spray Units, Car Washing Systems and High Pressure Grease Guns



3 ton performance
At 1½ ton cost

The new Highway Tanker, a drop frame trailer especially designed for transporting oil tanks behind a 1½ ton truck makes it possible to combine the economies of the light truck with the efficiency and performance of 3 ton models.

Now in use by many oil companies it is setting new records of economy and performance. The Highway Tanker carries an 800 to 1000 gallon tank, and is ideal for use in bulk and substation deliveries.

Made in the world's largest trailer plants

Highway Trailers many models which save money for all branches of the oil industry, from oil well to filling station, are completely engineered and manufactured, with the exception of rubber tires and Timken bearings, in the world's largest trailer plants.

Write for details of models especially designed and built for the oil industry.

HIGHWAY TRAILER CO.

Main Office and Plant;
Edgerton, Wis.
Plant No. 2,
Stoughton, Wis.

OIL PRICE HANDBOOKS

HAVE you a complete record of REFINERY prices; TANK WAGON markets; EXPORT prices; CRUDE prices—

For quick reference and comparison with today's prices?

The OIL PRICE HANDBOOK is the only complete record of oil markets for a whole year, compiled in one handy volume for quick reference. Cloth bound—marginal index—9″ x 6″—146 pages.

Oil Price Handbook for 1928.....$5
" " " for 1927.....$5
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Send for these OIL PRICE HANDBOOKS *now*, before they are all gone.

National Petroleum News, 735 Penton Bldg., Cleveland, Ohio

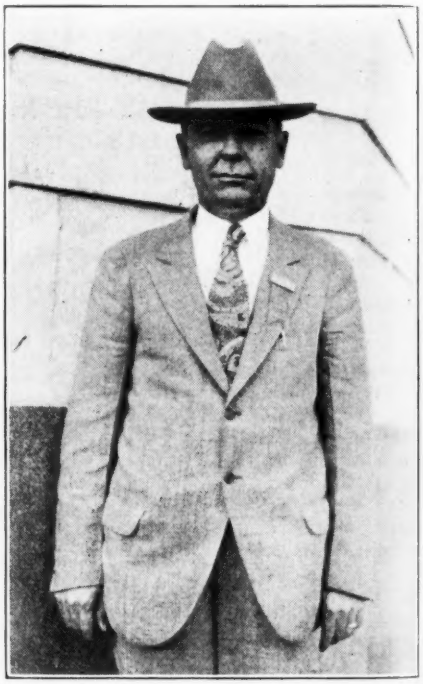
These stands also permit the drums to be tilted until practically the last drop is drained.

* * *

MANY service stations sell automobile light bulbs as a convenience to motorists. The revenue from these bulbs is small and selling them has some disadvantages.

When a motorist wants a bulb, he usually needs it and if he buys it at a service station he usually expects the station salesman to install it. Installation involves some little hazard, that of breaking a lens, and replacement of a broken lens will eat up the margin of profit on a great many lamps. That is perhaps the chief reason more oil companies have not handled bulbs.

Sets of bulbs may now be obtained in tin boxes. The assortments vary according to the cars on which they are to be used. Selling a set increases the margin of profit received from one customer. Also, if a motorist buys a set in a box he may not expect to have a burned out lamp replaced on the spot. He may put the box in his car and take it home with him.



Tom H. Lawson, Wichita Falls division manager of the new Continental Oil Co.'s southwestern marketing organization, reached his present position from the old Continental Oil Co., of Denver. He began his oil industry career with the Texhoma Oil & Refining Co., prior to its sale to the Denver Continental several years ago

How Do You Label Containers on Small Gasoline Sales at Stations?

CLEVELAND

AN OIL company in southern Ohio sold gasoline to a 10 year old boy in a quart milk bottle. What was supposed to be a profit of a few pennies on a sale of a quart of gasoline turned out to be a loss of $700. The boy's clothing caught fire while on the way home with the gasoline. A woman nearby threw the contents of the unlabeled bottle on the boy, thinking it was water. Upon the boy's death the parents brought suit for $25,000, but the case was settled out of court for $700.

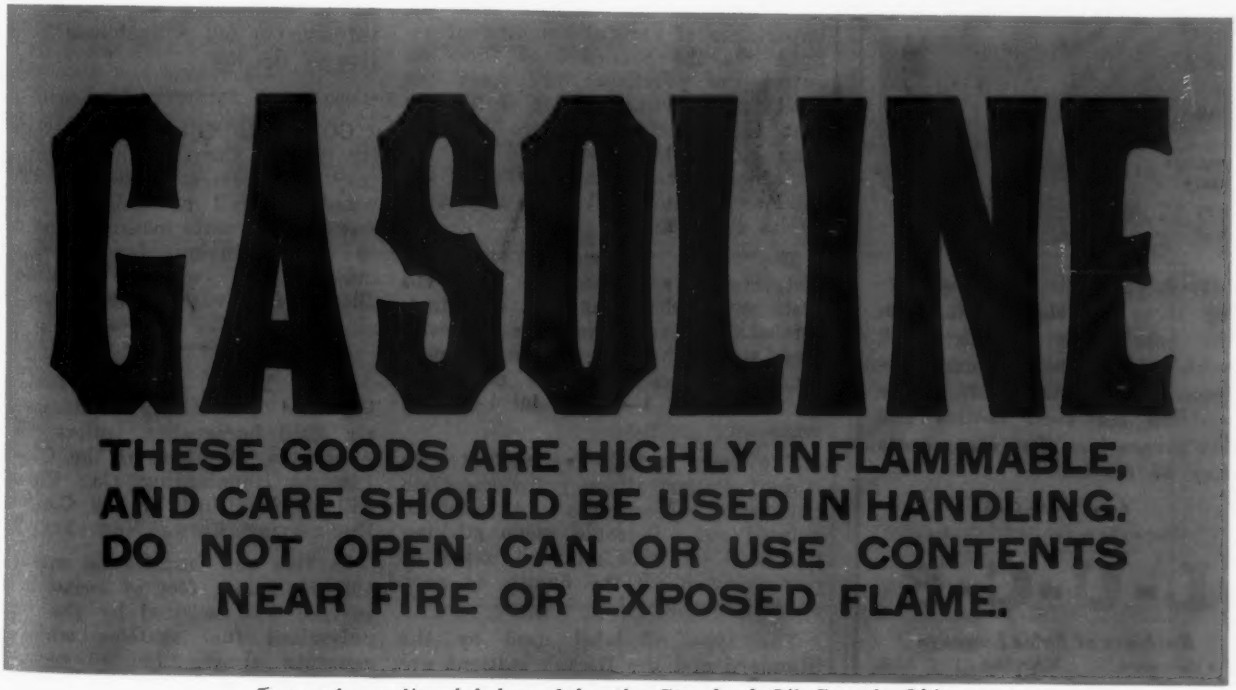
The liability of an oil company in selling gasoline, naphtha, or kerosene in containers at service stations may be all out of proportion to the profit involved. The misuse of gasoline or naphtha—cleaning in a closed room or basement where the fumes may settle for days, or opening the container near an open flame—is a hazard still with us even in the large cities. Natural or artificial gas for heating and cooking in larger cities has largely replaced kerosene and reduces the hazard of mistaking gasoline for kerosene in lighting a fire.

The oil company also is at a disadvantage when a damage suit resulting from a fire or explosion gets into court as the jury is apt to lean backwards in protecting the citizen against the "big oil company."

A check of distributors in Cleveland, Ohio, showed that the volume of sales in containers was not large compared to the total business done at the stations. Generally this trade was in the poorer neighborhoods, and was regarded as a nuisance. As one distributor put it these sales come mainly when the attendants are busy servicing automobiles.

The oil companies in Cleveland are protecting themselves, the check showed, by using labels on gasoline,

Placards for service stations issued by the Wisconsin oil inspection department. If customers want gasoline in containers not painted red the attendant can use the sign for passing the "buck" to the inspection department in refusing to sell


GASOLINE
THESE GOODS ARE HIGHLY INFLAMMABLE,
AND CARE SHOULD BE USED IN HANDLING.
DO NOT OPEN CAN OR USE CONTENTS
NEAR FIRE OR EXPOSED FLAME.

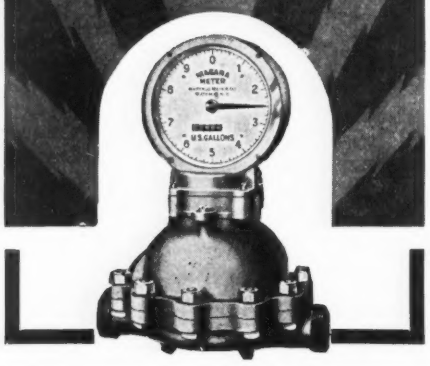
Type of gasoline label used by the Standard Oil Co. of Ohio

DEPENDABILITY

The Niagara meter never forgets—never jots down wrong totals—never delivers uncounted gallons of gasoline or oil that cut into profits. If the Niagara registers 50, fifty gallons have gone through—if 50,000, fifty thousand gallons have been delivered, and recorded so they'll be paid for. It is accurate.

The Niagara installed today is installed for years from now—its dependability is permanent. It is "rugged" structurally and simple mechanically. Send today for the new catalog of these familiar meters.

BUFFALO METER COMPANY
2889 Main Street
Buffalo, N. Y.



Reinforced Folio

Your Name in Gold FREE

Complete Only
$13.35

362—A very compact folio, having three pockets. Made from the best grade smooth black cowhide. Stiffened bottom reinforced with metal studs. Case contains six 4-oz. bottles and five grease jars. Two inner cases may be carried.

Less 10% for Cash
Other styles in our FREE Catalog

L-U-C-E

Builders of Sales Luggage
614 Delaware, KANSAS CITY, MO.

naphtha and kerosene containers.

Some of the oil companies protect themselves to the extent of refusing to sell these commodities to children. The Standard Oil Co. of Ohio, The Texas Co. distributor, and the Columbia Refining Co. have adopted this policy. The Pocahontas Oil Co. discourages such sales.

The Standard of Ohio refuses to sell gasoline to adults when it is to be used for cleaning purposes. This policy is used on account of the practice of cleaning gloves with gasoline, then drying over a stove or open fire.

Sales of gasoline in containers for less than a gallon are refused also by Standard of Ohio. This rule is transgressed however in certain cases; such as a painter working in the neighborhood coming to a station for a small quantity to clean his brushes.

Red labels for gasoline and naphtha, and green labels for kerosene are used generally by the Cleveland distributors. These labels carry the name of the product, and sometimes an additional warning.

"Gasoline, warning highly inflammable, not to be used to light fires, do not open can or use near fire nor stove or exposed flame," is the warning, printed on a red background, used by the Great Western Oil Co.

Cities Service Oil Co. uses a red label with "Gasoline, inflammable" printed in black. Kerosene labels are printed in green with the wording, "Kerosene, inflammable."

The label used by the Standard of Ohio and at a station of the Hickok Producing Co. reads: "Gasoline, these goods are highly inflammable, and care should be used in handling. Do not open can or use contents near fire or exposed flame."

To impress the customer with the importance of careful handling of refined oils the Standard of Ohio requires the purchaser to attach the label to his container. It is thought that this practice is more effective than having the attendant label the container. The customer handles the label and is more apt to be impressed by its significance.

The Great Western Oil Co. also instructs its attendants to warn the customers verbally as well as attach a label to the container. One oil company writes the name of the commodity on a piece of handy cardboard or paper and ties this label to the container.

The word attach is indefinite, so Hubert Fuller, attorney for the Ohio Petroleum Marketers Association, pointed out. It could mean sticking the label on with gummed paper or just tying it on the handle or neck of the container.

The type of label used by the Standard and the Hickok stations are printed on gummed paper, 6½ x 3½ inches. These can be padded in order to be kept clean and in an orderly pile at stations.

Some of the companies provide cans, painted red, for use in emergencies; such as taking gasoline to a stalled automobile nearby. These emergency containers are provided by the Pocahontas Oil Co., Great Western Oil Co., and the Standard of Ohio.

A further precaution, that of having a register for all sales at stations other than direct to automobiles, was suggested by Mr. Fuller in a recent issue of the Ohio Petroleum Marketers Association magazine. The register would contain the name and address of the purchaser, date, quantity and for what purpose intended. A station would have a record of all sales in containers in case it were involved in a damage suit through fire or explosion.

Wisconsin is enforcing its "red can" law through the oil inspection department. The law provides that gasoline, naphtha, benzine or any similar petroleum product sold in containers must be put in a can painted a vermilion red, with the name of the product painted on the container. The law also forbids the putting of kerosene in a red container. Penalty for violation of the law is $5 to $1000 or 30 days to six months in jail.

The oil inspection department distributes placards for use at service stations, calling attention to the "red can" law. The placard is to give the station attendant a graceful way to refuse a customer wanting gasoline placed in an illegal container. The attendant can call the customer's attention to the placard, and passes the "buck" to the state inspection department. Oil companies are cooperating with the department, said Roy L. Brecke, state inspection supervisor, as it eliminates any ill-will from refusing to sell a customer in violation of the law.

CONNERSVILLE, Ind.—Adaptability of the Connersville patented rotary displacement meters to the unusual as well as ordinary requirements of accurate measurement of gas in manufacturing, is illustrated in bulletin 305 of the Connersville Blower Co., with headquarters here.

NEW YORK—Complete fuel burning and pulverizing equipment for six 3256 horsepower boilers for the Ashtabula, O. plant of the Cleveland Electric Illuminating Co., Cleveland, will be furnished by the Combustion Engineering Corp., New York.

In this new installation more than 195,000 square feet of boiler heating surface will be fired by the Lopulco pulverized fuel systems which will generate about 2,700,000 pounds of steam per hour.

The 1309-square-foot automobile service station of Rosy's Accessories, Inc., at Tenth street and Seventh avenue, New York. An average of 2000 cars are lubricated or have their brakes, springs and shock absorbers serviced here each month. The station has five hydraulic lifts and an electric brake tester. The vacant triangle to the left was where Rosy began a lubrication business six years ago and was known as Rosy's Grease Spot. When a speculator bought it Rosy's tore down a house the company had bought next door. Sam Rosenberg, one of four brothers that own Rosy's, is in his short shirt sleeves at the left of the picture

Personal Attention Brings 2000 Cars A Month Into Tiny Lube Station

By Roger B. Stafford
N. P. N. STAFF WRITER

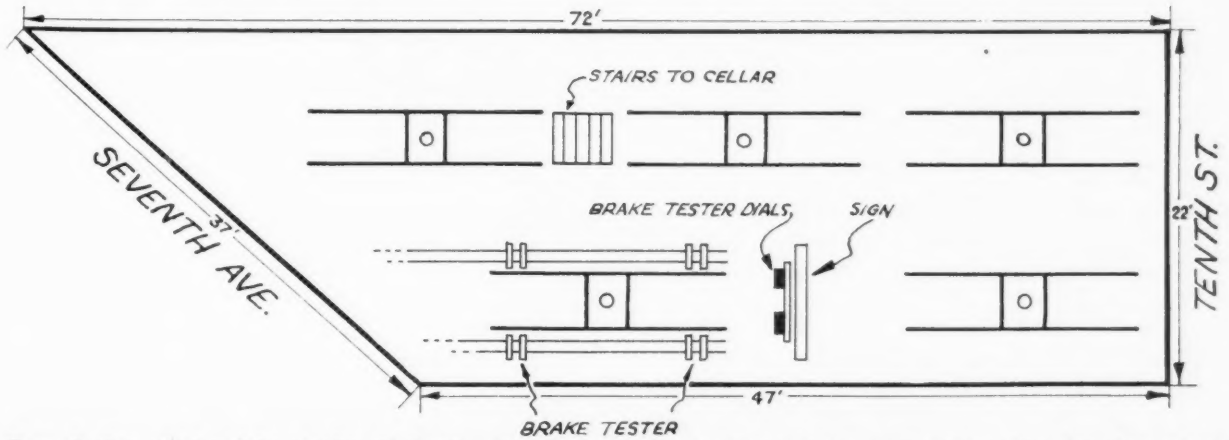
ROSY'S GREASE SPOT has been eradicated from Greenwich Village but Rosy is still in business under a more dignified name and on a tiny lot adjacent to the automobile service spot which with its five intertwined lifts had become a landmark on lower Seventh avenue.

Rosy's new and larger station, now called Rosy's Accessories, Inc., occupies a grand total ground space of 1309 square feet yet it services an average of 2000 cars a month largely because of the personal attention given each customer by the owners of Rosy's.

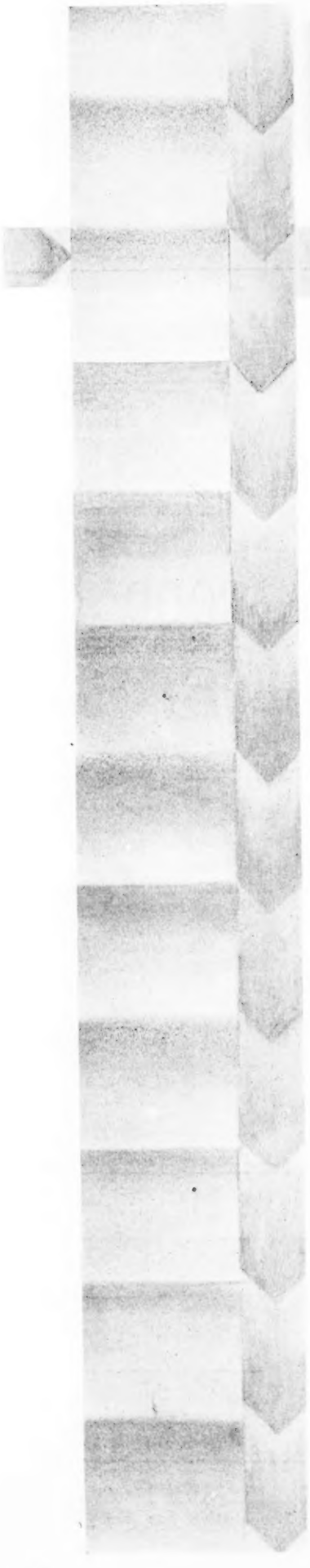
The new station lot is 22 feet wide and has a length of 72 feet on one side and 47 feet on the other.

In addition to the five lifts which were moved from the former site, the original Grease Spot, when a speculater later wanted $35,000 or close to $50 a square foot for the lot, are an electric brake tester, storage space for two cars, a stairway to a deep storage cellar, and small spaces around the edges for grease drums, oil cans, air hose, and the tools used in lubricating and servicing.

Before the speculator bought the ground Rosy's Grease Spot occupied at Tenth street and Seventh avenue, there was room only for the five lifts, which some puzzle expert seemed to have arranged, the oil and grease receptacles and the tools. There was no brake tester and no storage space. Cars had to wait in the street if



Ground plan of tiny lube station of Rosy's Accessories, Inc., in New York. The station has five free-wheel lifts, one of which is set inside an electric brake tester



MORRISON

Backed by three-quarters of a century of careful, yet progressive manufacturing experience, Morrison oil marketing equipment is always newest in design and covers the widest range of purposes.

Morrison tanks are fabricated for numerous oil handling purposes. Long and dependable service is built into every Morrison tank.

This carefully made steel equipment consists of bulk storage, underground, air receivers and truck tanks.

TANKS

There's a Morrison dealer near, anxious to serve you. Write for his name.

all lifts were filled and street parking is something that doesn't go well with New York police unless you are "on the inside."

There are four persons that make up Rosy. They are the Rosenberg brothers,—Leon, Sam, Abe and Bernard. They have been greasing cars for about six years, said Sam, who bosses this tiny station most of the time. Before that they had a filling station in the same block on Seventh avenue they are now in. Gasoline didn't pay so they quit it and took up lubrication and accessories.

In addition to lubrication, they test and service brakes, sell tires, do some valve grinding and motor overhauling, service shock absorbers, put on new fenders which New York traffic indicates are needed frequently, and install springs, but sell no gasoline. They handle several widely known motor oils so they are able to supply almost any car owner with his pet brand.

ACROSS Seventh avenue the brothers now own a good sized accessory and tire store. They are New York city distributors for a premium make of tires and fenders of a manufacturer who supplies original equipment to many automobile factories.

"It's the personal attention we give the cars and owners that get us the volume of trade here," said Sam Rosenberg who was keeping things moving one afternoon a short time ago. "When I'm not here one of my brothers is here. I know most of the people that call," and he proceeded to repeat some names well known in New York theatrical and business circles, whose owners were his customers.

The station is right in the heart of Greenwich Village and near to the homes of those old New Yorkers who were not carried uptown or to the suburbs in the exodus from the village when the artists and bohemians moved in 20 years or so ago. Those people have money and cars.

Some of the old families who did leave are returning as skyscraper apartments and hotels are replacing many of the red brick and brownstone houses that once lined the streets shoulder to shoulder. These people and the newer rich who like to live in the heart of things offer with their cars an excellent neighborhood trade.

Then there are the taxicabs and commercial cars whose business may be obtained regularly. Part of the traffic to and from the Holland tubes under the Hudson river passes through Seventh avenue, and this represents some transient business but not much.

The personal attention which brings in the repeat customers has built Rosy's business until this last summer

ALLIANCE THOROWELD TANKS

The Final Word on

TANKS

We build "Thoroweld" Tanks for Every Purpose. Sizes from 65 to 26,000 gallons capacity. Standard Sizes Carried in Stock. We are Especially Fitted to Build Welded Tanks to Your Specifications. Also Plate and Stack Work, Riveted or Welded, to Your Specifications.

ALLIANCE THOROWELD TANKS

"Thoroweld" Tanks are built in a Modern Plant, with Modern Equipment and by Experienced Workmen. Every Tank we ship is Fully Guaranteed. Our Engineering Service is at Your Command.

"THOROWELD" TANKS WILL FORM A PERFECT "ALLIANCE" BETWEEN US

The ALLIANCE TANK Co.

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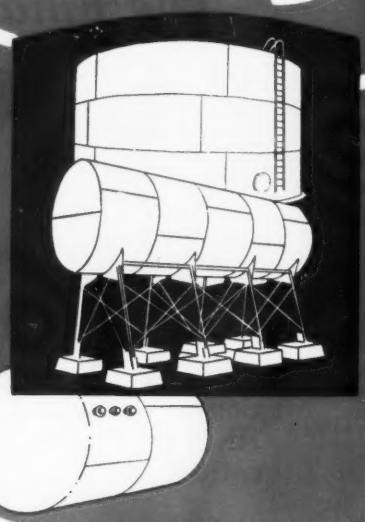
TANKS

AN INGALLS BIRTANK PRODUCT

For Any Oil Or Gas Storage

Specify "Birtanks" on your next tank order and insure getting the best tanks that money can buy. And too, you are sure of getting them quick for we maintain large stocks of standard sizes ready to ship.

Let us quote.



TANKS FOR EVERY USE

BIRMINGHAM TANK CO.,
Birmingham, Ala.

New York • New Orleans • Atlanta • Miami • Tampa • Jacksonville

Research Testing Expert Testimony

Equipped with facilities and the experience of years for authoritative

CHEMICAL AND PHYSICAL TESTS ON PETROLEUM AND ITS PRODUCTS

COSMA LABORATORIES CO.

1545 E. 18th St. Cleveland, Ohio

an average of 77 cars were serviced each business day.

The men employed at the station are automobile mechanics and can overhaul an engine as well as change the oil or grease the chassis. They reline and adjust brakes, adjust shock absorbers, and do all the other jobs that are required except major overhauls of cars which space and time preclude.

But after each job is completed it is checked by Sam Rosenberg or another of the brothers to see that nothing has been overlooked or slighted. This inspection is just another phase of the personal attention the Rosenberg's are proud of and to which they attribute their doing a big business on a tiny lot.

The station's lift installation is unique. The lifts are hydraulic and instead of being able to place the wells in the ground it has been necessary to suspend them from the ceiling of the storage cellar.

The cellar is deep and has a capacity for several carloads of merchandise—tires, fenders, and oils in cans and drums.

Alexander Tells of Work Against Misbranding

CLEVELAND, Oct. 25.—Rodney J. Alexander, executive secretary of the Pennsylvania Grade Crude Oil Association, has just issued a signed article to the press explaining the nature of the association and its work to prevent substitution and misbranding in the marketing of Pennsylvania grade motor oils.

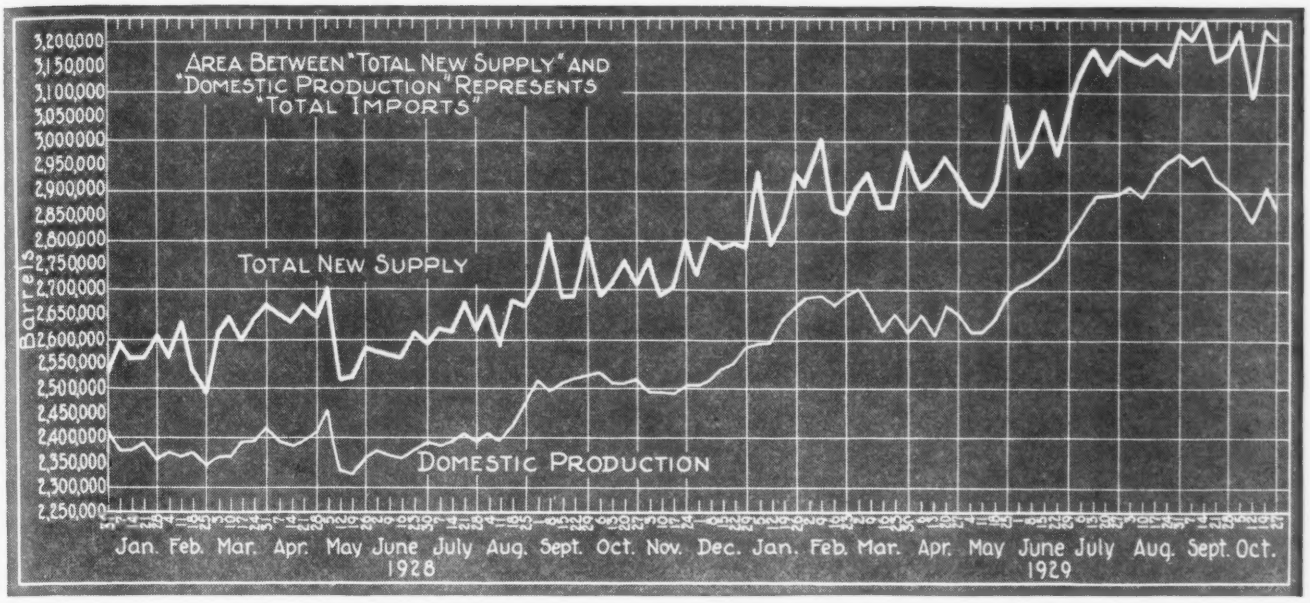
Mr. Alexander discusses the use of the abbreviation "Penn" in branding oils which are only partly Pennsylvania and in which no Pennsylvania oil is used.

"We meet these cases of infringement or imposition on the word 'Pennsylvania' in various ways. In some cases proceedings are instituted in the United States Patent Office to prevent the registration of brands which seem to infringe on the Pennsylvania idea," he writes.

"At other times evidence is brought before the Federal Trade Commission. Corrective action has been exercised repeatedly by the Better Business Bureaus in various parts of the country. In some cases prosecution is necessary. But we prefer the methods of education and reason, and usually find these methods effective.

"Every member, whether directly or indirectly affiliated with our organization, who is authorized to sell a Pennsylvania brand of his own under the association emblem, must become a party to a bond, involving the forfeiture of $1000. The bonded member obligates himself to secure and give a written guarantee that oil he buys or sells for resale under the association emblem is made exclusively from Pennsylvania grade crude oil."

Daily Average Crude Oil Production and Imports



Daily average gross output of United States, by fields, for week ending with dates below as compiled by American Petroleum Institute

PRODUCTION SUMMARY

	Oct. 26	Oct. 19
Production east of Rockies	1,989,200	2,020,700
Decrease		31,500
Total production in U. S.	2,869,700	2,903,200
Decrease		33,500
Crude oil imports	331,857	317,286
Increase		14,571
Total crude supply	3,201,557	3,220,486
Decrease		18,929

OKLAHOMA

	Oct. 26	Oct. 19
Allen Dome	23,600	24,550
Asher	5,500	7,000
Blackwell	3,700	3,800
Bowlegs	28,150	30,650
Braman	3,700	4,000
Bristow-Slick	20,500	20,500
Burbank	18,050	18,100
Carr City	9,850	10,150
Cromwell	7,600	7,800
Cushing	15,500	15,750
Davenport	1,350	1,350
Duncan District	8,300	8,000
Earlsboro	66,500	69,100
East Seminole	5,800	6,500
Fox	1,350	1,350
Garber	4,750	4,550
Graham	3,950	4,000
Healdton	12,600	12,550
Hewitt	7,800	7,750
Hubbard	1,700	1,800
Little River	71,250	79,350
Logan County	16,000	16,500
Maud	9,450	10,100
Mission	18,950	20,050
North Okmulgee	11,850	12,300
Oklahoma City	73,400	75,450
Osage (outside Burbank)	25,800	25,850
Papoose	3,300	3,300
Pearson	950	1,000
St. Louis	54,750	56,150
Sasakwa	10,400	12,100
Scholem-Alechem	12,800	12,750
Searight	10,600	11,300
Seminole	28,950	31,150
South Okmulgee	7,150	7,850
Thomas	800	750
Tonkawa	8,750	8,500
Wewoka	4,300	4,300
Yale-Jennings	6,500	6,500
Others	54,450	53,750
Total, Oklahoma	680,650	708,250
Decrease		27,600

KANSAS

Augusta-Fox Bush	2,950	2,950
Churchill	5,900	6,100
Eldorado-Towanda	13,000	13,000
Florence-Covert	950	950
Greenwood County	20,200	20,350
Oxford	3,850	4,000
Peabody-Elbing	3,250	3,250
Rainbow Bend	1,050	1,050
Russell	3,000	3,050
Sedgwick County	20,250	20,800
Others	36,300	36,000
Total, Kansas	110,700	111,500
Decrease		800

NORTH LOUISIANA

Bellevue	650	650
Caddo, light	12,500	13,700
Caddo, heavy	3,050	3,050
Cotton Valley	2,500	2,500
De Soto and Red River	3,150	3,150
Elm Grove	550	550
Haynesville	4,800	4,850
Homer	3,750	3,800
Pleasant Hill	1,000	1,050
Urania	5,800	5,750
Others	450	400
Total, North Louisiana	38,200	39,450
Decrease		1,250

ARKANSAS

Champagnolle	5,250	5,600
El Dorado	4,350	4,400
Lisbon	1,200	1,150
Nevada	1,050	1,050
Smackover, light	5,800	5,800
Smackover, heavy	45,200	45,700
Stephens	1,000	1,000
Others	100	100
Total, Arkansas	63,950	64,800
Decrease		850

TEXAS (Outside Gulf Coast)

Panhandle District

Carson County	10,200	9,750
Gray County	65,450	67,200
Hutchinson County	27,500	29,000
Wheeler County	550	800
Others	900	900
Total, Panhandle Texas	104,600	107,650
Decrease		3,050

North Texas

Archer County	18,400	18,600
Burkburnett	9,150	9,200
Electra	11,600	11,750
Iowa Park and K. M. A.	4,550	4,650
Montague-Cooke	16,800	17,000
Wilbarger	30,600	30,900
Others	800	800
Total, North Texas	91,900	92,900
Decrease		1,000

West Central Texas

Brown County	11,000	10,500
Callahan County	3,500	3,500
Coleman County	8,000	7,600
Eastland-Desdemona	6,750	6,800
Jack County	3,800	3,900
Palo Pinto County	550	550
Shackleford County	10,000	10,000
Stephens County	6,400	6,400
Throckmorton County	600	600
Young County	6,400	6,500
Others	1,000	950
Total, West Central Texas	58,000	57,300
Increase		700

West Texas

Crane and Upton Counties	47,650	45,100
Crockett County	2,250	2,300
Howard County	38,400	39,900
Jones County	2,750	3,000
Mitchell and Scurry Counties	2,500	2,500
Pecos County	139,000	138,600
Reagan County	17,500	17,200
Winkler County	110,550	112,500
Others	2,800	3,400
Total, West Texas	363,400	364,500
Decrease		1,100

East Central Texas

Boggy Creek	3,450	3,400
Corsicana-Powell	7,000	6,800
Currie	450	400
Mexia	5,250	5,150
Nigger Creek	250	300
Richland	300	350
Van Zandt County	300	1,000
Wortham	1,000	1,050
Total, East Central Texas	18,000	18,450
Decrease		450

Southwest Texas

Dale	400	400
Laredo District	9,300	9,350
Luling	10,700	10,500
Lytton Springs	900	900
Refugio County	13,350	10,550
Salt Flat	36,000	37,000
Somerset	1,300	1,200
Others	2,900	3,100
Total, Southwest Texas	74,850	73,000
Increase		1,850
Total, Texas (Outside Gulf Coast)	710,750	713,800
Decrease		3,050

GULF COAST

Coastal Texas

Barbers Hill	21,950	20,700
Batson	1,300	1,300
Big Creek	4,400	4,450
Blue Ridge	2,500	2,150
Boling	1,400	1,400
Damon Mound	600	600
Goose Creek	5,700	5,700
Hull	10,850	10,800
Humble	12,300	13,100
Orange County	2,800	2,750
Pierce Junction	11,400	11,400
Raccoon Bend	8,500	8,650
Saratoga	1,000	1,000
Somerville	1,800	2,000
Sour Lake	2,500	2,600
South Liberty	6,400	5,850
Spindletop	23,400	23,300
Sugarland	12,400	11,400
West Columbia	6,600	6,700
Others	9,500	7,650
Total, Coastal Texas	147,300	143,500
Increase		3,800

Coastal Louisiana

East Hackberry	1,800	1,800
Edgerly	600	600
Evangeline	1,600	1,700
Lockport	3,900	4,100
Old Hackberry	2,100	2,300
Sorrento Dome	150	150
Sulphur Dome	7,000	7,000
Vinton	4,650	4,200
Others	1,900	2,300
Total, Coastal Louisiana	23,700	24,750
Decrease		1,050
Total Gulf Coast	171,000	168,250
Increase		2,750

ROCKY MOUNTAIN

Wyoming

Big Muddy	2,200	2,250
Elk Basin	550	750
Grass Creek	2,150	2,150
Labarge	2,100	2,200
Lance Creek	150	200
Lost Soldier	3,950	3,950
Oregon Basin	4,400	4,550
Rock Creek	2,250	2,300
Salt Creek	31,350	32,300
Others	4,250	4,300
Total, Wyoming	53,350	54,950
Decrease		1,600

Montana

Cat Creek	1,200	1,300
Pondera	2,800	2,600
Sunburst	6,900	6,800
Others	50	50
Total, Montana	10,950	10,750
Increase		200

Colorado

Florence	700	750
Fort Collins	1,900	1,850
Moffat (Craig)	1,100	1,150
Others	1,650	1,700
Total, Colorado	5,350	5,450
Decrease		100

New Mexico

Artesia	850	850
Balance Lea & Eddy County	2,950	3,000
Hogback	400	400
Rattlesnake	1,700	1,700
Table Mesa	100	100
Others	400	400
Total, New Mexico	6,400	6,450
Decrease		50
Total, Rocky Mountain	76,050	77,600
Decrease		1,550

CALIFORNIA

	Oct. 26	Oct. 19
Dominguez	8,000	8,000
Elwood-Goleta	34,000	31,500
Huntington Beach	42,000	42,000
Inglewood	23,000	23,000
Kettleman Hills	10,000	10,000
Long Beach	169,000	169,000
Midway-Sunset	71,500	71,500
Santa Fe Springs	270,000	273,000
Seal Beach	37,500	38,500
Ventura Avenue	62,000	62,500
Others	153,500	153,500
Total, California	880,500	882,500
Decrease		2,000

EASTERN

(Including Ill., Ind., Ky., O., W. Va., Pa., and N. Y.)	119,800	120,250
Decrease		450
Michigan	18,100	16,800
Increase		1,300

Compilation Of Mid-Continent Refinery Operations

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Mid-Continent Refinery Operations Week Ended October 25 (By Telegraph)

	Kansas	Oklahoma	North & Cent. Texas	West Texas	North La.-Ark.	Total Week Ended Oct. 25
Plants Reporting	12	29	25	15	12	93
Da. Av. Cap. (Bbls.)	92,000	160,200	86,600	81,500	54,900	475,200
Da. Cracking Capacity	30,700	52,600	17,200	5,000	22,700	128,200
Da. Av. Crude Runs	59,146 — 0.1	116,568 — 2.6	67,084 — 1.5	47,822 + 1.4	64,227 — 0.2	354,847 — 1.0
Da. Av. Other Oils	9,432 + 37.6	5,602 + 37.1	2,195	1,703 — 25.0	2,222 — 2.5	21,154 + 45.2
GASOLINE—Gallons						
Stocks, Oct. 18	11,083,000	48,373,000	14,937,000	8,371,000	10,640,000	93,404,000
Prod. 10-18 to 10-25	10,716,000 + 9.1	18,275,000 — 5.2	8,635,000 — 1.3	4,228,000 — 12.0	5,898,000 — 5.8	47,752,000 — 2.4
Ship. 10-18 to 10-25	9,902,000 + 8.6	19,743,000 + 0.01	8,343,000 + 2.3	3,095,000 — 9.0	5,917,000 + 9.2	47,000,000 + 2.5
Stocks, Oct. 25	11,897,000 + 7.3	46,905,000 — 3.0	15,229,000 + 2.0	9,504,000 + 13.5	10,621,000 — 0.2	94,156,000 + 0.8
Ratio Sales to Prod.	92.4%	108.0%	96.6%	73.2%	100.3%	98.4%
KEROSENE—Gallons						
Stocks, Oct. 18	8,764,000	5,722,000	1,872,000	38,000	1,096,000	17,492,000
Prod. 10-18 to 10-25	1,878,000 — 13.9	2,666,000 + 16.9	1,747,000 + 5.3	8,000 — 60.0	512,000 — 16.1	6,811,000 + 0.9
Ship. 10-18 to 10-25	970,000 — 34.3	2,208,000 — 4.5	1,373,000 — 11.9	18,000 — 48.6	526,000 — 21.3	5,095,000 — 15.8
Stocks, Oct. 25	9,672,000 + 10.4	6,180,000 + 8.0	2,246,000 + 20.0	28,000 + 26.3	1,082,000 — 1.3	19,208,000 + 9.8
Ratio Sales to Prod.	51.7%	82.8%	78.6%	225.0%	102.7%	74.8%
STOVE DISTILLATE—Gallons						
Stocks, Oct. 18	2,545,000	5,836,000	1,366,000	173,000	154,000	10,074,000
Prod. 10-18 to 10-25	706,000 + 61.9	1,158,000 + 6.9	269,000 — 14.6	113,000 — 5.0	220,000 + 35.8	2,466,000 + 16.6
Ship. 10-18 to 10-25	576,000 +232.9	1,047,000 + 24.3	102,000 — 62.1	170,000 + 86.8	234,000 + 1.7	2,129,000 + 32.6
Stocks, Oct. 25	2,675,000 + 5.1	5,947,000 + 1.9	1,533,000 + 12.2	116,000 — 32.9	140,000 — 9.1	10,411,000 + 3.3
Ratio Sales to Prod.	81.6%	90.4%	37.9%	150.4%	106.3%	86.3%
GAS OIL—Gallons						
Stocks, Oct. 18	4,346,000	38,628,000	4,305,000	13,393,000	4,726,000	65,398,000
Prod. 10-18 to 10-25	1,545,000 + 4.8	1,763,000 — 4.3	527,000 +273.8	899,000 — 42.2	2,168,000 + 7.2	6,902,000 — 1.9
Ship. 10-18 to 10-25	1,373,000 + 0.7	754,000 — 61.3	1,611,000 +167.1	376,000 — 23.3	1,563,000 — 26.2	5,677,000 — 13.0
Stocks, Oct. 25	4,518,000 + 4.0	39,637,000 + 2.6	3,221,000 — 25.2	13,916,000 + 3.9	5,331,000 + 12.8	66,623,000 + 1.9
Ratio Sales to Prod.	88.9%	42.8%	305.6%	41.8%	72.1%	82.3%
FUEL OIL—Gallons						
Stocks, Oct. 18	14,941,000	43,427,000	66,901,000	29,868,000	19,982,000	175,119,000
Prod. 10-18 to 10-25	4,280,000 — 8.9	8,740,000 + 16.5	8,157,000 — 6.0	7,224,000 + 4.2	6,286,000 + 7.1	34,687,000 + 3.0
Ship. 10-18 to 10-25	4,877,000 + 9.0	8,302,000 — 7.2	8,548,000 + 30.0	6,690,000 + 21.0	5,235,000 — 22.8	33,652,000 + 3.5
Stocks, Oct. 25	14,344,000 — 4.0	43,865,000 + 1.0	66,510,000 — 0.6	30,402,000 + 1.8	21,033,000 + 5.3	176,154,000 + 0.6
Ratio Sales to Prod.	113.9%	95.0%	104.8%	92.6%	83.3%	97.0%

Gasoline Produced by Various Methods, Week Ended October 25

	Kansas	% of Total	Oklahoma	% of Total	North & Cent. Texas	% of Total	West Texas	% of Total	Louisiana-Arkansas	% of Total	Total	% of Total
Straight Run	6,799,000	63.4	11,888,000	65.0	6,520,000	75.5	3,902,000	92.3	2,198,000	37.3	31,307,000	65.6
Cracked	3,307,000	30.9	4,958,000	27.1	1,337,000	15.5	119,000	2.8	3,013,000	51.1	12,734,000	26.7
Natural	610,000	5.7	1,429,000	7.9	778,000	9.0	207,000	4.9	687,000	11.6	3,711,000	7.7
Total	10,716,000		18,275,000		8,635,000		4,228,000		5,898,000		47,752,000	

+ or — columns are % change over previous week.

Mid-Continent Gasoline Shipments Increase

Staff Special—By Telegraph
TULSA, Oct. 28

GASOLINE shipments from refineries reporting weekly operations to this publication increased 1,000,000 gallons for week ended Oct. 25 while production decreased by approximately the same total. Gasoline stocks accordingly increased only 700,000 gallons.

Crude runs for the district were lower by 3700 barrels daily average. Oklahoma was only district to show any sizable production change. Other districts were steady with the exception of West Texas which increased runs slightly.

Oklahoma and Louisiana-Arkansas were the only districts to draw on stocks. West Texas refiners had a ratio of sales to production of 73.2 for the week. Increase in shipments

Summary for the Month

Production and shipments, all reporting refineries, for four weeks ended Oct. 25. Change in stocks figures from Sept. 27.

GASOLINE

	Gallons
Production	192,865,000
Shipments	189,526,000
Net change in stocks	+3,339,000
Ratio sales to production	98.3%

KEROSENE

Production	27,739,000
Shipments	23,837,000
Net change in stocks	+3,902,000
Ratio sales to production	85.9%

STOVE DISTILLATE

Production	8,887,000
Shipments	7,569,000
Net change in stocks	+1,318,000
Ratio sales to production	85.2%

GAS OIL

Production	30,285,000
Shipments	27,532,000
Net change in stocks	+2,753,000
Ratio sales to production	90.9%

FUEL OIL

Production	132,132,000
Shipments	132,500,000
Net change in stocks	—368,000
Ratio sales to production	100.3%

was fairly well distributed throughout the area.

Kerosene shipments were lower while production increased slightly with result stocks were increased 1,700,000 gallons. Only in West Texas and Louisiana-Arkansas were stocks reduced.

Cold weather in the north stepped up distillate shipments somewhat but production was still at levels which caused some of the output to be placed in storage. Gas oil and fuel oil stocks were increased, the former by 1,200,000 gallons and the latter by 1,000,000 gallons.

Richfield Acquires Eastern Marketers

LOS ANGELES, Oct. 26.—Acquisition of the Heath Oil Co. of Binghamton, N. Y. by Richfield Oil Corp. of New York was announced Oct. 23 by A. C. Woodman, former president of the Heath Co.

This purchase adds more than 2,000,000 gallons per year to the gasoline outlet of Richfield in the eastern states. The 10 retail filling stations and a bulk terminal at Binghamton are considered to be in a key position for that part of New York state.

With the purchase of the Heath company, Richfield has recently added to its sales outlets seven bulk terminals and 207 retail filling stations with an aggregate yearly output of approximately 29 million gallons of gasoline. Other purchases were the Peerless Oil Co. with 167 retail stations and bulk distributing plants at Scranton and Philadelphia, Pa., and Camden and Newark, N. J.; Cleary Service chain of 10 stations and one bulk plant at Rochester, N. J.; and 20 stations and one bulk plant of the Lamson Oil Co., Providence, R. I.

Anderson Will Succeed Wood

TULSA, Oct. 26.—A. F. Wood, sales manager for the Chestnut & Smith Corp., has resigned effective Nov. 1. His future connection has not been made public but a formal announcement was expected within a few days.

Mr. Wood will be succeeded by C. W. Anderson, formerly sales manager for the Naturaline Co., a subsidiary of Chestnut & Smith. Mr. Anderson, prior to his connection with the Naturaline Co., was with the former Marland Refining Co. in the sales department.

Mr. Wood has been with Chestnut & Smith for the past 12 years. He was promoted to sales manager several years ago when D. E. Buchanan was promoted from sales manager to general manager.

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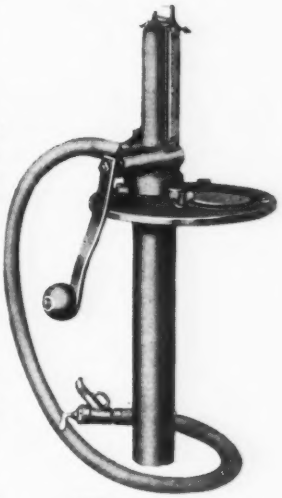

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SHIPPING Weight
Both Models 27 lbs.

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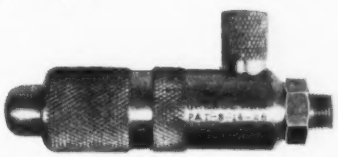

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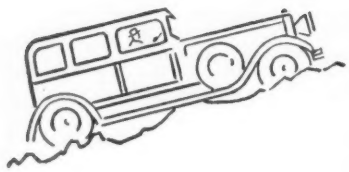

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Export Buying Stiffens Gasoline In Mid-Continent Markets

Staff Special
TULSA, Oct. 26

HEAVY purchases of gasoline for export—approximately 18 million gallons—resulted in the elimination of several low spots in the Mid-Continent gasoline market during the week of October 21 to 26. A more optimistic feeling was noted in all districts.

Refiners in virtually all districts shared in the export business, transacted by several export buyers who are members of the Export Petroleum Association.

Domestic gasoline business from a resale standpoint improved considerably although demand from jobbers remained generally unchanged.

Natural gasolines continued to be in good demand in most quarters, and some over November buying developed late in the week.

Kerosene demand was reported improved but prices were generally unchanged. Distillates and gas oil were in better demand. Fuel oils were in heavy demand and a few grades advanced fractionally in price during the week. Neutral oils and bright stocks were steady. Wax was in good demand at generally unchanged prices.

Gasolines

Mid-Continent refiners at the close of the week were more optimistic than they had been for several weeks, as a result of the heavy export buying which was followed almost immediately by heavy buying on the part of some of the domestic trade.

The export buying amounted to over 18 million gallons of 64-66, 375 e.p. and 61-63, 390 e. p. gasolines, at prices of 7.75 and 7.50 cents, respectively, f.o.b. north Texas plants. Buyers were members of the Export Petroleum Association.

This buying will give some refiners an opportunity to ship some of the gasolines they have held in storage this summer in anticipation of better export demand, and will give others an opportunity to get away from the domestic market almost wholly for the remainder of the year. The shipment period for the export gasolines is November and December.

When the trade learned the export buyers were in the market, there was a diligent check made of the Mid-Continent for 58-60 U. S. Motor and 58-60, 437 e. p. gasolines. This check was made principally by marketers who wished to cover before there was a possibility of an increase in refinery prices for domestic gasolines.

One Tulsa marketer was known to have bought for several accounts more than 200 cars of gasoline within a day, and other buyers were almost as active.

Virtually all the soft spots in the market were canvassed with the result that refiners who had been selling at prices considerably under the prevailing quotations obtained sufficient business to keep them fairly well satisfied for the remainder of the month.

Some of the gasoline bought was full specification U. S. Motor but the bulk of the purchases was gasoline which was slightly off specification, either as to gravity or some intermediate point.

Gasoline prices in both Oklahoma and north Texas advanced 0.125 to 0.25 cent a gallon before the end of the week. All the 58-60, 437 e. p. gasoline in Oklahoma which had been quoted at 6.625 to 6.75 cents a gallon, was taken off the market and no quotations were checked Oct. 26 under 6.875 cents a gallon even on a resale basis.

The north Texas refiners undoubtedly will curtail production of U. S. Motor and swing to the 64-66, 375 e. p. cut with the result there will be less U. S. Motor from that district competing with other districts. This will give some relief to both west Texas and Louisiana and Arkansas.

Gasoline from Kansas area on a group 3 basis was fractionally higher at the close of the week, although no changes were noted in quotations on a Kansas destination basis.

High gravity gasolines increased in demand, due both to the export buying and the need for a higher grade of goods for winter use.

Natural Gasolines

No large spot buying of natural gasolines was reported but a steady demand from refiners, and from marketers who in some instances needed goods to cover on short sales, kept the market fairly active throughout the week.

Some over November buying also was reported by other manufacturers who reported the proration plan in the various fields would cut their gasoline production to the point where they would have to fill some of their orders with goods purchased on the outside.

Spot prices were generally unchanged throughout the week, but some of the over-November sales were reported at prices from 0.125 to 0.25 cent under spot quotations.

Kerosenes

Several refiners reported a slightly improved demand for kerosenes but the increase was not sufficient to have any effect on prices. This commodity apparently has about faded from the picture for the time being as far as domestic requirements are concerned. The only factor which could give it any encouragement at present would be a sizable export order, and so far there has been no indication of export business developing.

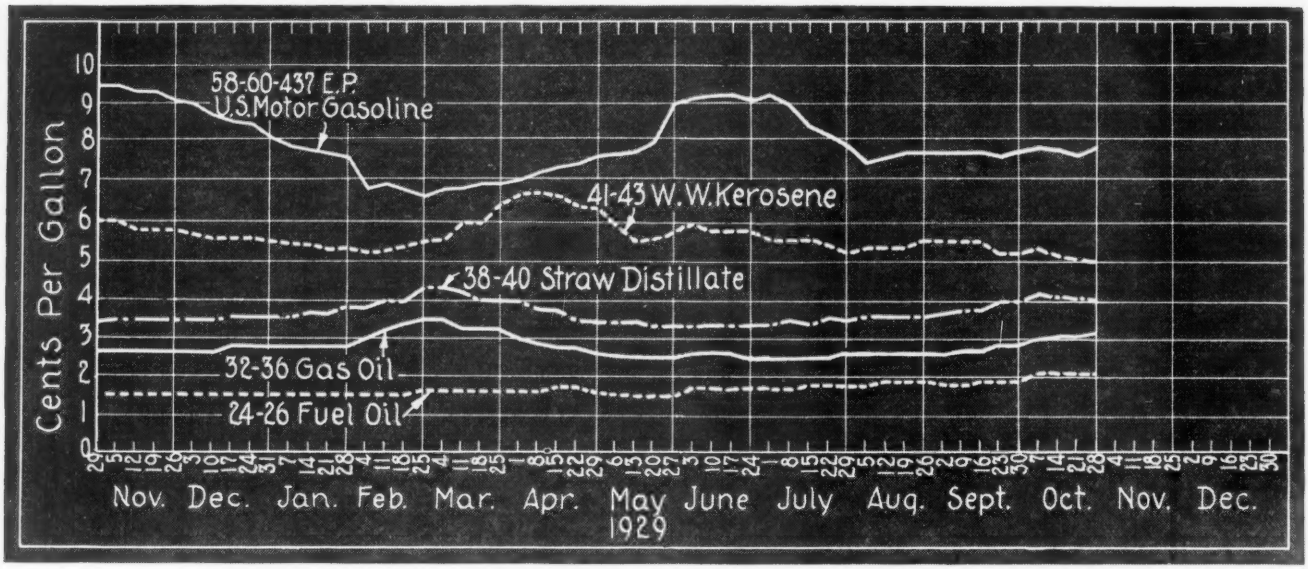
Distillates and Gas Oil

All grades of distillate and gas oil increased in demand as a result of the cold weather in the northern states. Several rush orders were received by refiners during the week. The sudden increase in demand checked the downward trend in prices.

Fuel Oils

The general fuel oil market was steady with a number of grades show-

Current Prices of Principal Mid-Continent Refined Products



Prices shown are in Group 3 basis and extended to date shown in Refinery Market Tables Section of this issue

ing slight advances in prices. The 28-30 and 24-26 gravity grades were not as scarce as they had been the past several weeks but there was no change in the price structure. The lower grades experienced most of the small price advance.

Neutral Oils, Bright Stock, Wax

Prices and demand were steady for both neutral oils and bright stocks. The latter commodity continued to be extremely scarce. Wax was in better demand in all quarters but prices showed no change over the previous week.

Jobbers Active in Gulf Coast

HOUSTON, Oct. 28.—More active jobber demand, plus commitment of a lubricant cargo for immediate export shipment by an Independent plant, strengthened the Gulf Coastal lubricant market at the end of October. Shading of prices below listed schedules was disappearing, although there was no general marking up of the various grades.

ENID, Oct. 26.—L. A. Snyder, sales manager for Champlin Refining Co. was confined to his bed this week with an attack of influenza which threatened for a time to develop into pneumonia.

Correction

Due to printers' error, natural gasoline prices in some of the Oct. 23 issue of NATIONAL PETROLEUM NEWS, were in error in the refinery market tables, page 98, in both the Oct. 21 and Oct. 14 columns of prices.

If your copy showed prices other than the ones quoted below, please correct them to the following:

Oklahoma-North Texas Naturals

Oct. 21, Grades B, BB and C 6.625-6.75c, instead of 6.375.

Oct. 14, Grades B, BB and C 6.375c, instead of 6.25-6.375.

North Louisiana Naturals

Oct. 21, Grades BB and C 7.00c, instead of 6.625.

O. H. Muller Leaves Pure Oil

CHICAGO, Oct. 25.—O. H. Muller, Jr., who for eight years has held various executive positions with the Pure Oil Co. has resigned. He has not announced his future plans.

Salesmen Discounts Ended In Kentucky Territory

CLEVELAND, Oct. 28.—Discounts on gasoline sold commercial travelers have been discontinued in Standard Oil Co. of Kentucky territory by the Standard and Gulf Refining Co. except in the case of a few non-cancelable contracts, according to officers of these two companies.

New commercial discount contracts follow the provisions of the code of ethics, it was said. These contracts cover only the types of vehicles specified in the code or the interpretations.

Cancellation of cancellable contracts with salesmen has been going on since early October, when the directors of the American Petroleum Institute banned discounts to salesmen.

Shipments From Southern California

LOS ANGELES, Oct. 28.—Bulk petroleum shipments from Southern California ports for week ending October 19 were as follows:

Destination	Crude	Fuel	Gasoline	Diesel	Distillate	Kero.
Pacific Foreign	167,079	152,406	.....	50,473	.....	.....
Atlantic Domestic	.....	.....	396,282	.....	78,538	.....
Atlantic Foreign	.....	.....	236,516	.....	.....	7,662

Prices 10 Years Ago
Oct. 27, 1919

	Oklahoma	Penna.
58-60 U. S. Motor.....	17.00–17.25c	20.25–20.50c
80-84 Natural	22.75–23.00c	.....
Kerosene (41-43 Okla.; 47 w. w. Pa.)	10.00–10.50c	12.50–12.75c
Fuel Oil (24-26 Okla.; 38-40 Pa.)	$0.90	6.00–6.50c
Crude (Okla. 35-35.9)	$2.25	$4.25
Chicago tank wagon	.....	21.00c

Prices A Year Ago
Oct. 29, 1928

	Oklahoma	Penna.
58-60 U. S. Motor.....	9.5772c	11.00–11.50c
Grade A Natural	10.125–10.25c	.....
Kerosene (Okla. 41-43; Pa. 47 w. w.)	6.00c	8.125–8.50c
Fuel Oil (Okla. 24-26; Pa. 36-40)	$0.65–$0.675	4.50–5.00c
Crude (Okla. 35-35.9)	$1.31	$3.35
Chicago tank wagon....	.....	15.00c

Chicago Resale Market

Export Buying Helps Chicago Gasoline

Staff Special

CHICAGO, Oct. 26

UNDER the stimulus of heavy export gasoline buying in the Mid-Continent, the Chicago resale gasoline market showed signs of life for the first time in several weeks. Spot prices were moving upward as the week closed Oct. 26.

Prior to these purchases spot gasoline prices were slowly working to lower levels as has been the case for the past few months. Sales of 58-60 U. S. Motor, both out of Oklahoma and Texas, were reported at 6.75 to 6.875 cents by carlot marketers. They reported that they could obtain some U. S. Motor for resale at 6.50 cents on Oct. 23 and that it was freely offered at 6.625 cents.

Following the announcement of the export purchases, marketers started hunting for this low priced goods and while a few were able to place orders at 6.625 cents, most of them said they were having to pay at least 6.75 cents. On Oct. 26, most of the Chicago marketers were quoting U. S. Motor for prompt shipment to jobbers at 6.875 to 7 cents.

The larger refiners continued to hold their spot U. S. Motor gasoline prices at 7.75 cents, but, with one or two exceptions, they reported no sales at this figure. Most of them, however, were enjoying a good demand from their contract jobbers. Other refiners were generally quoting from 6.875 cents up to 7.50 cents and reported doing a fair business.

Possibly the main topic under discussion among the Chicago trade Oct. 26 was whether or not the new lineup of higher prices was only temporary. Some sellers said the fear of a tank wagon reduction would hold down any buying by jobbers except as they actually needed goods and that unless the weather was unusually favorable for motoring, prices would be moving downward within ten days or two weeks.

Others were more optimistic and figured that enough goods had been bought to keep any distress material off the market for at least another month and that possibly when the market started downward again, there would be more export orders placed. However, most marketers apparently were unwilling to go long any large amount of gasoline and evidently were going to play safe for the present.

Predictions were made freely during the week that tank wagon prices would be cut by Standard of Indiana on Nov. 1, but nothing official was forthcoming from the Standard offices. These reports were based on the fact that price cutting has become considerably more prevalent than for some time past. However, since the Oklahoma crude oil situation appears well under control and since spot prices, for the present at any rate, are higher, it looks altogether possible that there may be nothing done until the latter part of next month.

As might be expected after the large amount of export buying, the higher gravity gasolines were quoted at higher prices on Oct. 26 and while domestic demand was not brisk, most sellers were expecting an increase shortly.

Activity in kerosene was practically non-existent the past week, according to reports from most quarters. Demand was so quiet that a number of marketers were not quoting any prices. Sales of 41-43 w.w. were reported from 4.50 cents upward, which in some cases was no higher than was being quoted on 38-40 prime white distillate.

Although the snow and colder weather over this territory during the early days of the week apparently were responsible for a better business among the burner oil distributors, there was not much activity in these oils in the spot tank car market. Most jobbers were well stocked with zero oils and several reported that unless the weather in November was exceptionally cold they would have enough in storage to cover that period. Prices were generally unchanged over the week.

Rather frequent periods of precipitation, with temperatures mostly normal or above are predicted for the Standard of Indiana territory next week.

CHICAGO—A device for the testing of fluidity of motor oils at various temperatures, known as the consistometer, is being used by many refiners and marketers, according to letters received by the Consistometer Corp., 332 S. Michigan Ave., manufacturer of this machine.

The characteristics of various motor oils, consisting of the hot test breakdown and the cold test fluidity test, for comparison purposes and for standardizing and improving motor oils, are determined by this machine. It is of rigid and sturdy construction and can be readily moved about when necessary.

GASOLINE DYES

BLUE
RED
GREEN
PURPLE
Any Color

COLORED GASOLINES STAND OUT CLEARLY AND ATTRACTIVELY BECKONING BUSINESS & INCREASING SALES

Trade **SOLOCOLOR** Mark

COLORED GASOLINES GIVE YOU A NEW MERCHANDISING ANGLE FOR A QUALITY PRODUCT

Write for prices and samples

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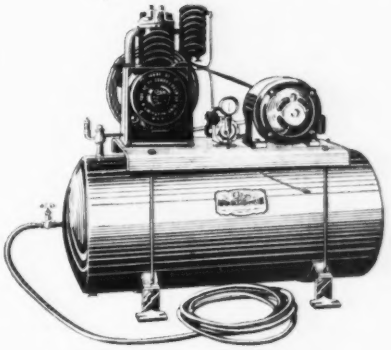
20 years of compressor building—
Knowledge of filling station needs—
Minimum of overhead costs—
Low first cost—long life—
Low upkeep cost—few repairs—

All these are yours in this 2 H. P. 60 gallon tank.

ALL-PURPOSE UNIT

The Oro T 58 GOOD as GOLD



Ask your jobber to sell you for **$215**

If your jobber does not carry, ask us.

THE AU-TO COMPRESSOR CO.

197 Mulberry St. Wilmington, Ohio
Export office, 126 Liberty St., New York City

Refinery Markets on Light Oils and Lubricants

Prices given below are in cents per gallon, F. O. B. refinery except where $ is shown

(These Refinery Prices compiled in the OIL PRICE HANDBOOK for a whole year)

Comparative Prices of 58-60 U. S. Motor Gasoline, 437 E. P., Group 3 and Point of Origin, to Jobbers Only

In Effect October 28

	Price F.O.B Group 3	*Price F.O.B. Point of Origin*	*If for Particular Destination*
Oklahoma	7.5938 (Wt. Avg.)	7.5938 (Wt. Avg.)	
Kansas	6.875-7.25		S. O. Neb. & Ind. Ter., etc.
Kansas		7.8500 (Wt. Avg.)	Kansas only.
North Texas	7.00	6.875-7.00	
West Texas	7.00	6.75-7.00	
Louisiana-Ark.	7.00-7.25		Mich., Ohio & Indiana.
Louisiana-Ark.		7.375	State or differential haul.
Indiana-Illinois	6.875-7.75	*	S. O. Ind territory except Detroit and vicinity. For Ohio on delivered basis only.

*Shipments made from E. Chicago, Ind., and Wood River, Ill., according to conditions and freight rates; no prices F.O.B. point of origin can be given.

Weighted Average Prices

OKLAHOMA

	Oct. 28		Oct. 21		Oct. 14	
	No. of cars	Price	No. of cars	Price	No. of cars	Price
58-60 U. S. Motor, 437 e. p.	52	7.5938	71	7.6831	69	7.6721
60-62 437 e. p. gasoline	No sales reported		1	7.6250	No sales reported	
60-62 400 e. p. gasoline	5	7.8500	4	8.0625	3	8.0000
64-66 375 e. p. gasoline	No sales reported		2	8.4375	5	8.4500

The export buying in the Mid-Continent drew price ranges closer late in the week, but the weighted averages showed only small change. Most of the low prices in Oklahoma were for resale or were for goods off specification.

These low prices accordingly did not appear in the weighted average compilation although they did have some slight effect on refiners who in a few instances met them for competitive purposes. The demand for gasolines from the jobbing trade was fair.

KANSAS

	Oct. 28		Oct. 21		Oct. 14	
	No. of cars	Price	No. of cars	Price	No. of cars	Price
58-60 U. S. Motor, 437 e. p.	2	7.5000	2	7.7500	1	7.7500

No changes were noted during the week in the price of gasoline for shipment from Kansas refineries to destinations within the state.

GASOLINE AND NAPHTHA

OKLAHOMA	Prices Oct. 28	Prices Oct. 21	Prices Oct. 14
48-50 450 e.p. naphtha	7.25 – 7.50	7.25 – 7.50	7.25 – 7.50
50-52 450 e.p. naphtha	7.25 – 7.50	7.25 – 7.50	7.25 – 7.50
56-58 450 e.p. gasoline	6.875–7.25	6.75 – 7.25	6.75 – 7.25
58-60 450 e.p. gasoline	6.875–7.25	6.75 – 7.375	6.75 – 7.375
64-66 390 e.p. gasoline	7.75 – 8.125	7.75 – 8.125	7.75 – 8.125
68-70 350-360 e.p. gasoline	8.00 – 8.375	8.00 – 8.375	8.00 – 8.375

†Prices nominal ††Only one refiner quoting *Quotations only

CHICAGO RESALE (F. o. b. Group 3, altho goods may originate elsewhere)

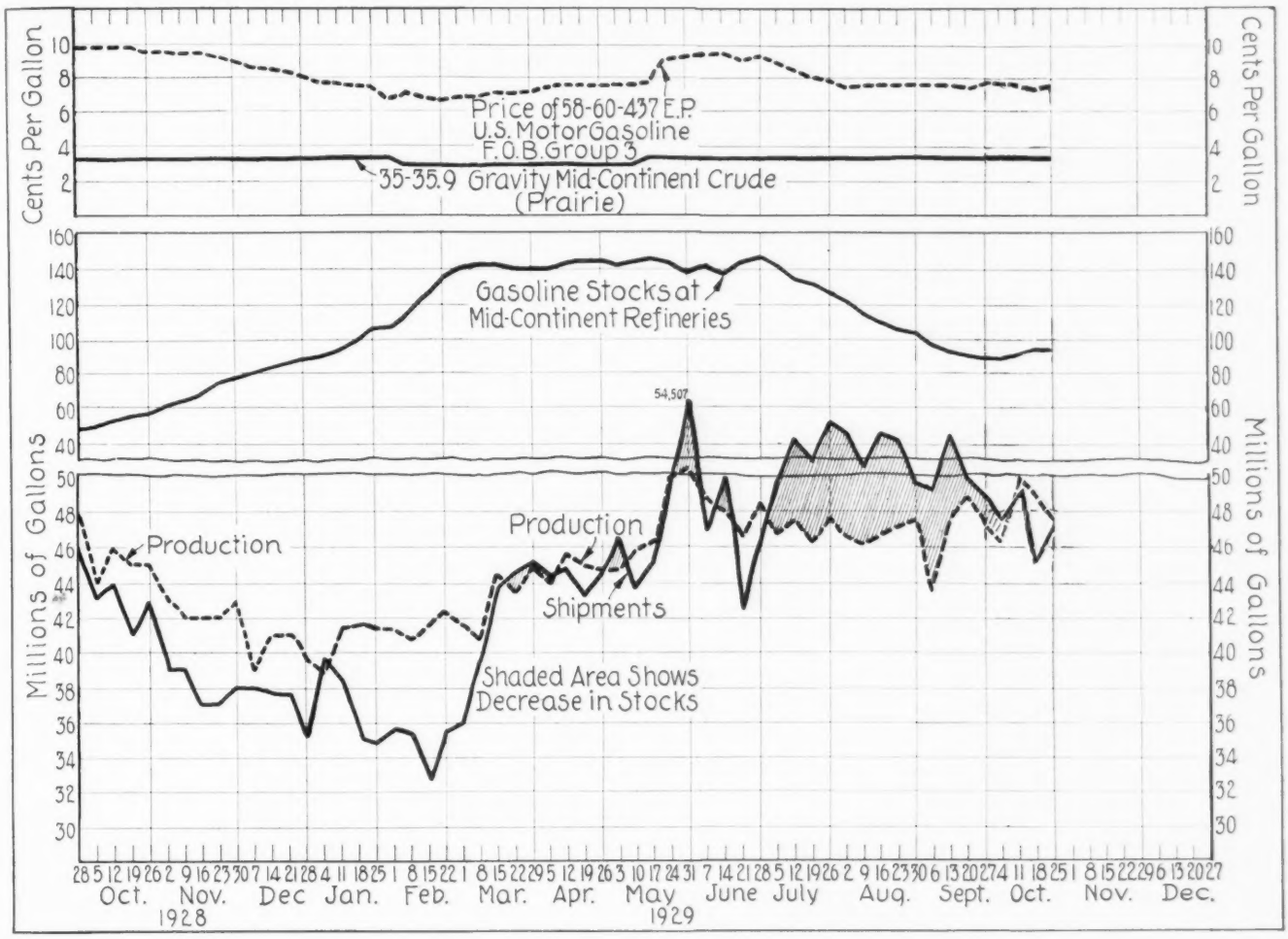
	Prices Oct. 28	Prices Oct. 21	Prices Oct. 14
58-60 U.S. Motor, 437 e.p.	6.875– 7.50	6.875– 7.75	6.875– 7.75
60-62 437 e.p. gasoline	7.125– 7.75	7.00 – 7.75	7.125– 7.75
60-62 400 e.p. gasoline	7.50 – 7.875	7.375– 7.875	7.375– 7.875
64-66 375 e.p. gasoline	7.875– 8.00	7.75 – 8.00	7.75 – 8.00

(Continued on Page 346)

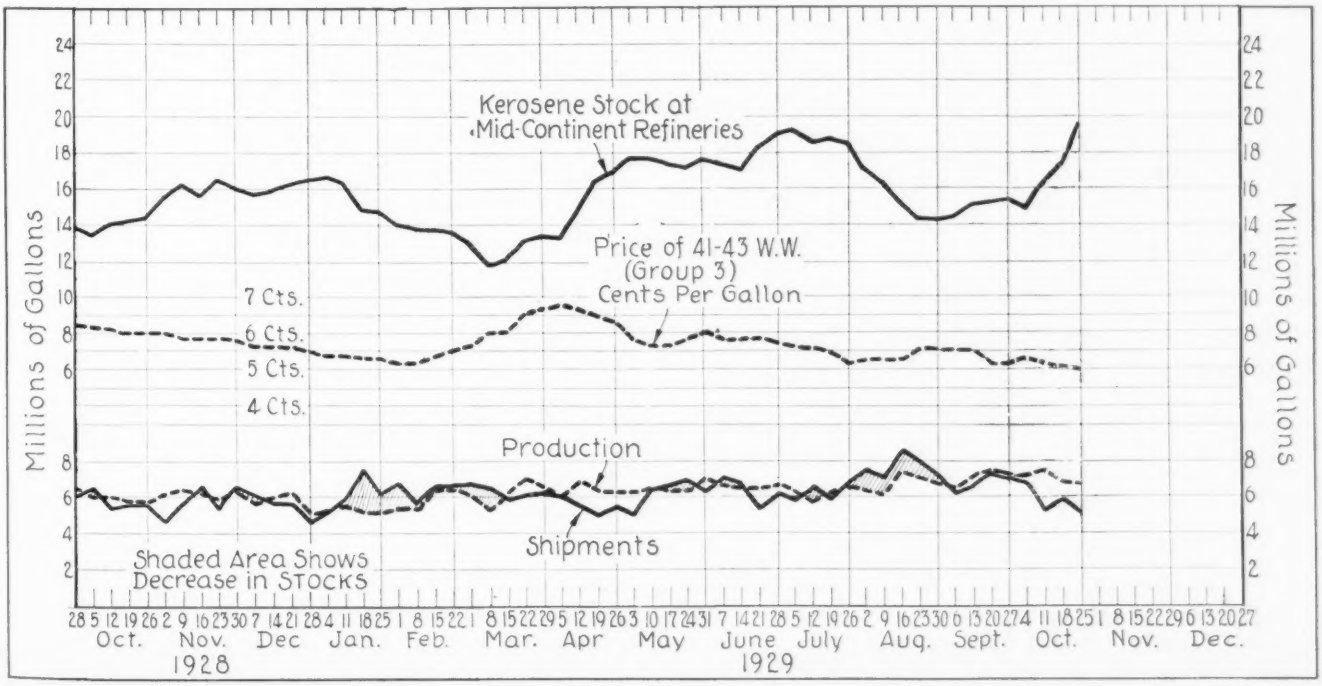
**Represents Both Sales and Quotations.

Barometer of Mid-Continent Refinery Market—Week Ending October 25

Charted Course of Prices, Production, Shipments, Stocks of Principal Refined Products, Week by Week, From Reports Made by 93 Plants to National Petroleum News


Cents Per Gallon
Price of 58-60-437 E.P. U.S. Motor Gasoline F.O.B. Group 3
35-35.9 Gravity Mid-Continent Crude (Prairie)
Gasoline Stocks at Mid-Continent Refineries
54,507
Millions of Gallons
Production
Shipments
Shaded Area Shows Decrease in Stocks
Oct. Nov. Dec Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
1928
1929

Prices shown above are extended to date shown in Refinery Market and Crude tables in Market section of this issue and stocks, shipments and Production are extended to date as shown in the table on page 338



Refinery Markets on Light Oils and Lubricants

Prices given below are in cents per gallon, F. O. B. refinery except where $ is shown

(These Refinery Prices compiled in the OIL PRICE HANDBOOK for a whole year)

PENNSYLVANIA

	Prices Oct. 28	Prices Oct. 21	Prices Oct. 14
52-54 Naphtha	8.00 – 8.25	7.50 – 8.25	7.75 – 8.25
54-56 Naphtha	8.00 – 8.50	7.75 – 8.25	8.00 – 8.50
58-60 U.S. Motor 437 e.p.	8.375– 9.00	8.50 – 9.00	8.50 – 9.00
60-62 400-410 e.p. gasoline	9.00 – 9.50	8.75 – 9.25	9.00 – 9.50
64-66 390 e.p. gasoline	9.25 –10.00	9.25 –10.00	9.50 –10.00
68-70 Str-run gas 350-360 e.p.	10.50 –11.00	10.00 –10.75	10.00 –10.75

OHIO (Quotations of S. O. Ohio. 4c state tax to be added.)

U. S. Motor Gasoline

Ohio, delivery at any point	10.00	10.00	10.50

KANSAS (F. O. B. refinery Kansas destination)

60-62 400 e.p. gasoline	7.75 – 8.00	7.75 – 8.00	8.00 – 8.125
64-66 375 e.p. gasoline	8.00 – 8.25	8.00 – 8.25	8.25 – 8.375

NORTH TEXAS

56-58 450 e.p. gasoline	6.625	6.50 – 6.625	6.50 – 6.625
58-60 450 e.p. gasoline	6.625– 6.75	6.625	6.625
58-60 U.S. Motor 437 e.p.	6.875– 7.00	6.75 – 7.00	6.75 – 7.00
60-62 400 e.p. gasoline	7.125– 7.25	7.00 – 7.25	7.00 – 7.25
64-66 390 e.p. gasoline	7.50 – 7.625	7.25 – 7.50	7.25 – 7.50
64-66 375 e.p. gasoline	7.75 – 7.875	7.50 – 7.625	7.50 – 7.75
68-70 350-360 e.p. gasoline	8.00 – 8.125	8.00 – 8.25	8.00 – 8.25

****WEST TEXAS (F.o.b. West Texas refinery, for unrestricted shipment**

50-52 naphtha	6.00 – 6.125	6.125– 6.25	6.125– 6.25
‡58-60 437 e.p. gasoline	6.625– 6.75	6.50 – 6.75	6.50 – 6.75
58-60 U.S. Motor 437 e.p. gasoline	6.75 – 7.00	6.75 – 7.00	6.875– 7.00

‡Gravity changed from 56-58 to 58-60 Oct. 7.

NORTH LOUISIANA (N. La., Ark. and Miss. destination)

58-60 390 e.p. gasoline	7.375	7.375	7.375– 7.50

ARKANSAS (Ark., N. La. and Miss. destination)

58-60 U.S. Motor 437 e.p.	7.375	7.375	7.375– 7.50

CALIFORNIA (3c tax to be added to California gasoline prices if used in state.)

54-58 U.S. Motor 437 e.p.	‡7.00 – 8.00	‡7.25 – 8.25	7.25 –10.25
58-61 375-400 e.p. gasoline	10.00 –11.25	10.00 –11.25	10.75 –11.25
42-45 Engine Distillate 445-480 e.p.	7.50 – 8.00	7.50 – 8.00	7.50 – 8.00

‡For outside state shipment price is 9.00–10.25.

NATURAL GASOLINE

(Note: End point of all grades, not over 375 F. Corrosion test adopted Oct. 1, 1927: A.S.T.M. Method D130-27T; doctor test, July 2, 1928.)

OKLAHOMA

Grade AA, 80-87.9, 90% Recovery	6.75 – 6.875	6.75 – 6.875	6.50
Grade A, 72-79.9, 90% Recovery	6.75 – 6.875	6.75 – 6.875	6.50
Grade BB, 84-92, 85% Recovery	6.75	6.625– 6.75	6.375
Grade B, 76-83.9, 85% Recovery	6.75	6.625– 6.75	6.375
Grade C, 80-92, 78% Recovery	6.75	6.625– 6.75	6.375

NORTH TEXAS (F. o. b. Breckenridge)

Grade AA, 80-87.9, 90% Recovery	6.75 – 6.875	6.75 – 6.875	6.50
Grade A, 72-79.9, 90% Recovery	6.75 – 6.875	6.75 – 6.875	6.50
Grade BB, 84-92, 85% Recovery	6.75	6.625– 6.75	6.375
Grade B, 76-83.9, 85% Recovery	6.75	6.625– 6.75	6.375
Grade C, 80-92, 78% Recovery	6.75	6.625– 6.75	6.375

NORTH LOUISIANA (F. o. b. Monroe District)

Grade AA	†7.00	†7.00	†6.625
Grade BB	†7.00	†7.00	†6.625
Grade C	†7.00	†7.00	†6.625

CALIFORNIA

75-85, 375-390 e.p. blend	8.00 – 8.50	8.00 – 8.50	8.00 – 9.00

†Prices nominal ††Only one refiner quoting *Quotations only

BURNING OILS

PENNSYLVANIA

	Prices Oct. 28	Prices Oct. 21	Prices Oct. 14
45 w.w. kerosene	6.875– 7.25	6.75 – 7.00	6.625– 6.875
46 w.w. kerosene	7.25 – 7.50	6.875– 7.25	6.75 – 7.125
47 w.w. kerosene	7.50 – 8.00	7.25 – 7.75	7.00 – 7.50
300 mineral seal	7.25 – 7.75	7.00 – 7.25	7.00 – 7.25

CHICAGO RESALE (F. o. b. Group 3, altho goods may originate elsewhere)

41-43 w.w. kerosene	4.625– 5.00	4.625– 5.00	4.875– 5.25

OKLAHOMA

41-43 w.w. kerosene	4.75 – 5.25	4.75 – 5.25	5.00 – 5.25
42-44 w.w. kerosene	5.25 – 5.75	5.25 – 5.75	5.25 – 5.75

KANSAS (F. O. B. refinery Kansas destination)

41-43 w.w. kerosene	5.50 – 5.75	5.50 – 5.75	5.50 – 6.00
42-44 w.w. kerosene	5.75 – 6.00	5.75 – 6.00	6.00 – 6.125

NORTH TEXAS

40-42 w.w. kerosene	4.25 – 4.375	4.25	4.375
41-43 w.w. kerosene	4.375– 4.625	4.375– 4.50	4.50 – 4.625

NORTH LOUISIANA (N. La., Ark. and Miss. destination)

41-43 w.w. kerosene	5.25 – 5.375	5.25 – 5.375	5.25 – 5.50
42-44 w.w. kerosene	5.50 – 5.625	5.50 – 5.625	5.50 – 5.625

ARKANSAS (Ark., N. La. and Miss. destination)

42-44 kerosene	5.50 – 5.625	5.50 – 5.625	5.50 – 5.625

CALIFORNIA

38-40 w.w. kerosene	5.00 – 6.00	5.00 – 6.00	5.00 – 6.00

NEUTRAL OIL

PENNSYLVANIA

Vis.		(Viscosity at 70°F.)	
200 No. 3 Assoc. Filt.	25.00 –26.00	24.00 –27.00	24.00 –27.00
180 No. 3 Assoc. Filt.	19.50 –22.00	18.50 –21.50	18.50 –21.50
150 No. 3 Assoc. Filt.	15.00 –18.00	15.00 –18.00	15.00 –18.00
		(Non Viscous)	
34 Grav. 330-340 Flash	7.375– 7.75	7.375– 7.75	7.375– 7.75

****OKLAHOMA**

Vis.	Color	(Viscosity at 100°F.)		
100	No. 2	6.00 – 7.00	6.00 – 7.00	6.00 – 7.00
150	No. 3	7.50 – 8.50	7.50 – 8.25	7.50 – 8.25
150	No. 4	6.75 – 7.50	6.75 – 7.50	6.75 – 7.50
180	No. 3	9.00 – 9.50	9.00 – 9.50	9.00 – 9.50
180	No. 4	8.75 – 9.25	8.75 – 9.25	8.75 – 9.25
180	No. 5	8.50 – 9.00	8.50 – 9.00	8.50 – 9.00
200	No. 3	9.50 –11.00	9.50 –11.00	9.50 –11.00
200	No. 4	9.00 –10.00	9.00 –10.00	9.00 –10.00
200	No. 5	8.75 – 9.50	8.75 – 9.50	8.75 – 9.50
220	No. 3	12.50 –13.50	12.50 –13.50	12.50 –13.50
220	No. 4	12.00 –12.50	12.00 –12.50	12.00 –12.50
220	No. 5	11.00 –12.00	11.00 –12.00	11.00 –12.00
240	No. 3	13.00 –13.50	13.00 –13.50	13.00 –13.50
240	No. 4	12.00 –13.00	12.00 –13.00	12.00 –13.00
240	No. 5	11.00 –13.00	11.00 –13.00	11.00 –13.00
280	No. 3	14.00 –16.00	14.00 –16.00	14.00 –16.00
280	No. 4	13.00 –15.00	13.00 –15.00	13.00 –15.00
280	No. 5	12.00 –14.00	12.00 –14.00	12.00 –14.00

****Represents Both Sales and Quotations.**

Refinery Markets Wax, Lubricants, Heavy Oil

Prices given below are in cents per gallon, F. O. B. refinery except where $ is shown

(For quick reference to Refinery Prices, get the OIL PRICE HANDBOOK, published annually)

GULF COASTAL

Vis.	Color	Prices Oct. 28	Prices Oct. 21	Prices Oct. 14
		(Viscosity at 100°F., pour test 0)		
100	No. 2 Pale	6.00 – 6.50	6.00 – 6.50	6.00 – 6.50
200	No. 3 Pale	9.00 – 9.50	9.00 – 9.50	9.00 – 9.50
300	No. 3 Pale	10.00 –10.50	10.00 –10.50	10.00 –10.50
500	No. 3½ Pale	11.50 –12.00	11.00 –11.50	11.50 –12.00
750	No. 4 Pale	12.50 –13.00	12.00 –12.50	12.50 –13.00
200	No. 5½ Red Oil	8.00 – 8.50	8.00 – 8.50	8.00 – 8.50
300	No. 5½ Red Oil	9.00 – 9.50	9.00 – 9.50	9.00 – 9.50
500	No. 6 Red Oil	9.50 –10.00	9.50 –10.00	10.00 –10.50
750	No. 6 Red Oil	11.50 –12.00	11.00 –11.50	11.50 –12.00

CALIFORNIA

Vis.	Color			
		(Viscosity at 100°F.)		
100	No. 3	9.50 –10.00	9.50 –10.00	9.50 –10.00
200	No. 3	11.50	11.50	11.50
300	No. 3	13.00	13.00	13.00
450	No. 3	15.50	15.50	15 50
550	No. 3	16.50	16.50	16.50
600	No. 3	17.00	17.00	17.00
200	No. 5	11.00	11.00	11.00
300	No. 5	12.00	12.00	12.00
400	No. 5	14.00	14.00	14.00
500	No. 5	15.00	15.00	15.00
600	No. 5	16.00	16.00	16.00
700	No. 7	18.00	18.00	18.00

CYLINDER STOCKS

**OKLAHOMA

190-200 Vis. D at 210° Brt. St.	40.00 –42.00	40.00 –42.00	40.00 –42.00
150-160 Vis. D at 210° Brt. St.	37.00 –38.00	37.00 –38.00	37.00 –38.00
150-160 Vis. E 210° Brt. St.	34.00 –35.00	34.00 –35.00	34.00 –35.00
600 St. Ref. Olive Green	10.00 –13.00	10.00 –13.00	10.00 –14.00
600 St. Ref. Dark Green	9.50 –12.00	9.50 –12.00	10.00 –13.00
Black Oil	5.00	5.00	5.00

PENNSYLVANIA (A. S. T. M. Tests)

600 Steam Refined, filterable	27.00 –30.00	27.00 –29.00	27.00 –29.00
650 Steam Refined	31.00 –32.00	29.00 –32.00	29.00 –32.00
600 Flash	33.00 –34.00	31.00 –33.00	31.00 –33.00
625 Flash	37.00	35.00 –37.00	35.00 –37.00
600 Warren E	32.00 –32.50	32.50	32.50
600 Oil City E	31.00 –32.00	31.00 –32.00	31.00 –32.00
600 D Filtered	36.50 –37.00	36.50 –37.00	36.50 –37.00
Cold Test Stock, 40-50 p. p., 140-150 vis. at 210° 540-550 flash, No. 8 color	51.00 –52.00	51.00 –53.00	52.00 –53.00
40-50 p.p., 140-150 vis. at 210°, 540-550 flash, No. 6-6½ color diluted	50.00 –51.00	50.00 –51.00	50.00 –51.00

WAX

PENNSYLVANIA (Per pound, New York)

122-124 white crude scale, a.m.p.	3.375– 3.50	3.25 – 3.50	3.25 – 3.375
124-126 white crude scale, a.m.p.	3.50	3.25 – 3.50	3.25 – 3.375

**OKLAHOMA

124-126 White Crude Scale, a. m. p.	3.00	3.00	2.875– 3.00

CALIFORNIA

White crude scale, per pound, ton lots, a.m.p.	6.00 – 6.50	6.00 – 6.50	6.00 – 6.50

DISTILLATE, GAS AND FUEL OIL

PENNSYLVANIA (For outside Pittsburgh district)

36-40 fuel oil	4.75 – 5.25	4.75 – 5.00	4.625– 5.00
30-34 fuel oil	4.625– 4.875	4.375– 4.50	4.375
28-32 fuel oil	4.625– 4.875	4.375– 4.50	4.375

†Prices nominal ††Only one refiner quoting *Quotations only

CHICAGO RESALE (F. o. b. Group 3, altho goods may originate elsewhere)

	Prices Oct. 28	Prices Oct. 21	Prices Oct. 14
38-40 straw distillate	3.875– 4.00	3.875– 4.00	4.00 – 4.125
32-36 ordinary dark gas oil	2.875– 3.00	2.875– 3.00	2.75 – 3.00
32-36 dark zero gas oil	3.00 – 3.25	3.00 – 3.25	3.00 – 3.25
32-36 straw zero gas oil	†3.125– 3.375	†3.125– 3.375	†3.25 – 3.375
28-30 zero fuel oil	†$1.15 –$1.20	†$1.10 –$1.20	†$1.10 –$1.20
28-30 fuel oil	$1.025–$1.075	$1.025–$1.075	$1.025–$1.075
24-26 fuel oil	$0.85 –$0.875	$0.80 –$0.825	$0.80 –$0.825
18-22 fuel oil, low sulfur	$0.65 –$0.675	$0.625–$0.675	$0.625–$0.675
18-22 fuel oil, high sulfur	$0.675–$0.70	$0.65 –$0.70	$0.65 –$0.675

OKLAHOMA

38-40 straw distillate	4.00	4.00 – 4.125	4.00 – 4.25
36-38 straw distillate	3.75 – 3.875	3.75 – 3.875	3.875– 4.00
32-36 straw gas oil	3.00 – 3.25	3.00 – 3.125	3.00 – 3.125
32-36 dark gas oil	3.25 – 3.50	3.00 – 3.125	3.00
32-36 straw zero gas oil	3.00 – 3.125	3.25	3.25
32-36 dark zero gas oil	3.25 – 3.375	3.125– 3.25	3.125– 3.25
28-30 zero fuel oil	$1.15 – 1.20	$1.15 – 1.20	$1.10 – 1.15
28-30 fuel oil (in bbls.)	1.05 – 1.10	$1.075– 1.10	1.05 – 1.10
26-28 fuel oil (in bbls.)	$0.90 – 0.95	$0.875– 0.925	$0.875– 0.90
24-26 fuel oil (in bbls.)	$0.85 – 0.90	$0.85 – 0.90	$0.825– 0.90
22-26 fuel oil (in bbls.)	$0.75 – 0.825	$0.725– 0.825	$0.70 – 0.825
18-22 fuel oil (in bbls.)	$0.625– 0.70	$0.65 – 0.725	$0.65 – 0.70
‡16-20 fuel oil (in bbls.)	$0.60 – 0.70	$0.60 – 0.70	$0.575– 0.60
14-16 fuel oil (in bbls.)	$0.55 – 0.65	$0.575– 0.70	$0.55 – 0.60

‡Gravity changed from 16-18 to 16-20, Aug. 19.

KANSAS (F. O. B. refinery Kansas destination)

38-40 straw distillate	4.25	4.25	4.25
36-38 straw distillate	4.00 – 4.125	4.00 – 4.125	4.00 – 4.25
32-36 gas oil	3.25 – 3.50	3.25	3.25
18-22 fuel oil	$0.70 – 0.75	$0.70 – 0.75	$0.70 – 0.75
10-14 fuel oil	$0.65 – 0.70	$0.625– 0.70	$0.65 – 0.70

NORTH TEXAS

38-40 straw distillate	3.625– 3.75	3.75 – 4.00	3.875– 4.00
32-36 gas oil, cracked	2.75 – 2.875	2.75	2.625
32-36 St. reduced gas oil	2.75 – 2.875	2.75 – 2.875	2.75
24-26 fuel oil (in bbls.)	$0.675– 0.70	$0.675– 0.70	$0.65 – 0.70
20-24 fuel oil	$0.625– 0.65	$0.625– 0.65	$0.625– 0.65
18-22 fuel oil	$0.60 – 0.625	$0.60	$0.60

**WEST TEXAS (F. o. b. West Texas refinery, for unrestricted shipment)

34-38 gas oil	3.00 – 3.125	3.00 – 3.25	3.00 – 3.25
30-32 fuel oil	2.875	.....	.....
28-30 zero gas oil	3.25	3.25	3.25
18-22 fuel oil	$0.525– 0.625	$0.55 – 0.65	$0.55 – 0.65

NORTH LOUISIANA (N. La., Ark. and Miss. destination)

32-36 gas oil, dark	3.50	3.50 – 3.625	3.50
32-36 gas oil, straw	3.50	3.50 – 3.625	3.50
14-16 fuel oil (in bbls.)	$0.75 – 0.80	$0.80	$0.75 – 0.80

ARKANSAS (Ark., N. La. and Miss. destination)

32-36 gas oil, straw	3.50	3.50 – 3.625	3.50
32-36 dark gas oil	3.50	3.50 – 3.625	3.50
28-30 gas oil	3.125– 3.25	3.125– 3.25	3.125– 3.25
14-16 fuel oil	$0.75 – 0.80	$0.80	$0.75 – 0.80

CALIFORNIA (F. o. b. San Joaquin Valley. At San Francisco 4c per bbl. more)

14-18 fuel oil (per bbl.)	$0.40 –$0.60	$0.45 –$0.60	$0.45 –$0.60
14-18 Bunker oil (per bbl.)	$0.70 –$0.75	$0.70 –$0.75	$0.70 –$0.75
30-34 gas oil (per bbl.)	$0.80 –$0.90	$0.85 –$0.90	$0.80 –$0.90
27 Plus Diesel oil (per bbl.)	$0.80 –$0.90	$0.85 –$0.90	$0.80 –$0.90

PETROLATUMS

PENNSYLVANIA (In barrels, carload lots, f. o. b. refinery. In tank cars $\frac{1}{2}$c to $\frac{3}{4}$c per pound less.) Two refiners quoting.

Snow White	8.50 – 8.75	8.50 – 8.75	8.50 – 8.75
Lily White	7.75	7.75	7.75
Cream White	6.75	6.75	6.75
Light Amber	3.75	3.75	3.75
Amber	3.50	3.50	3.50
Red	3.25	3.25	3.25

PETROLEUM COKE

**OKLAHOMA

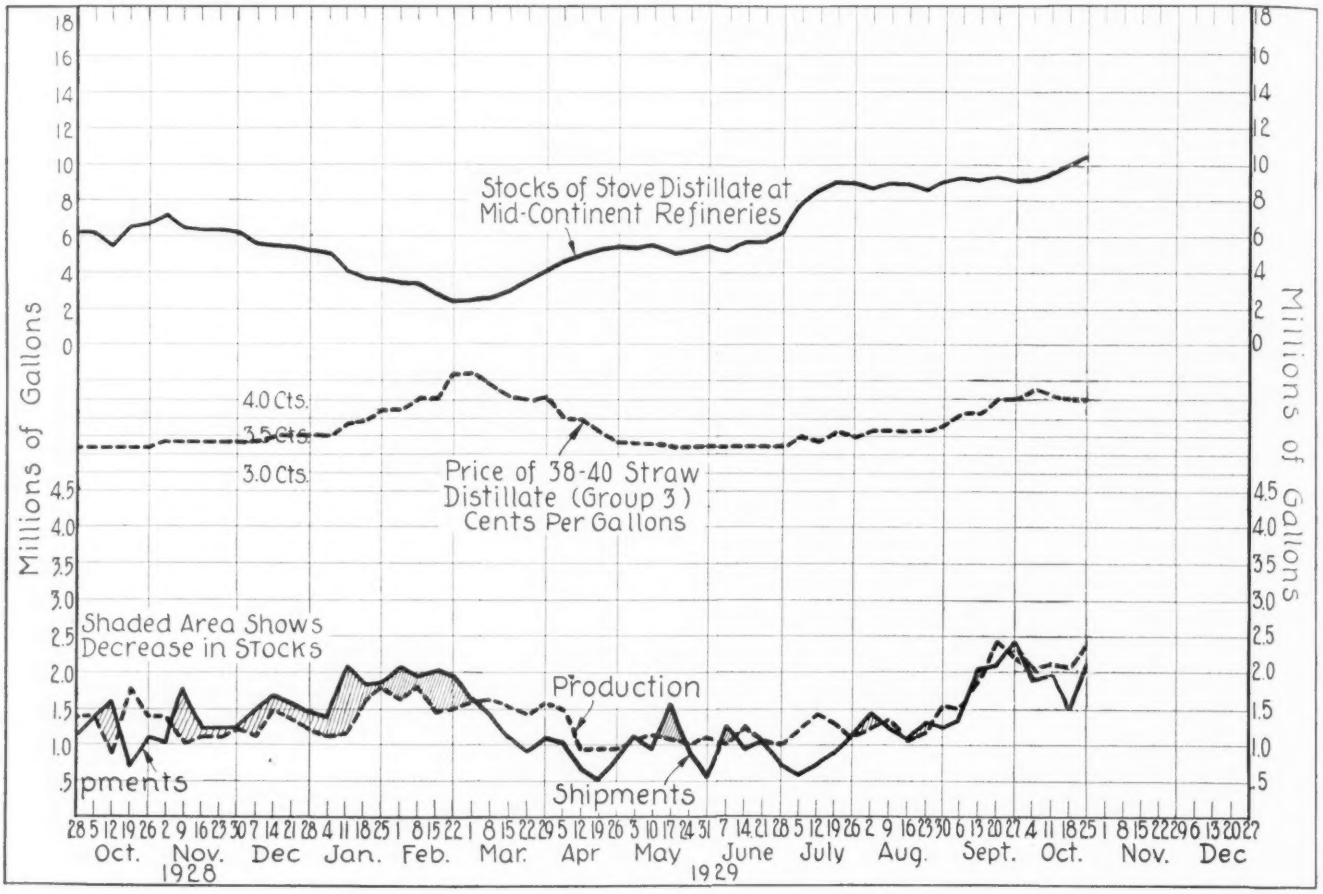
(Per ton in car lots)

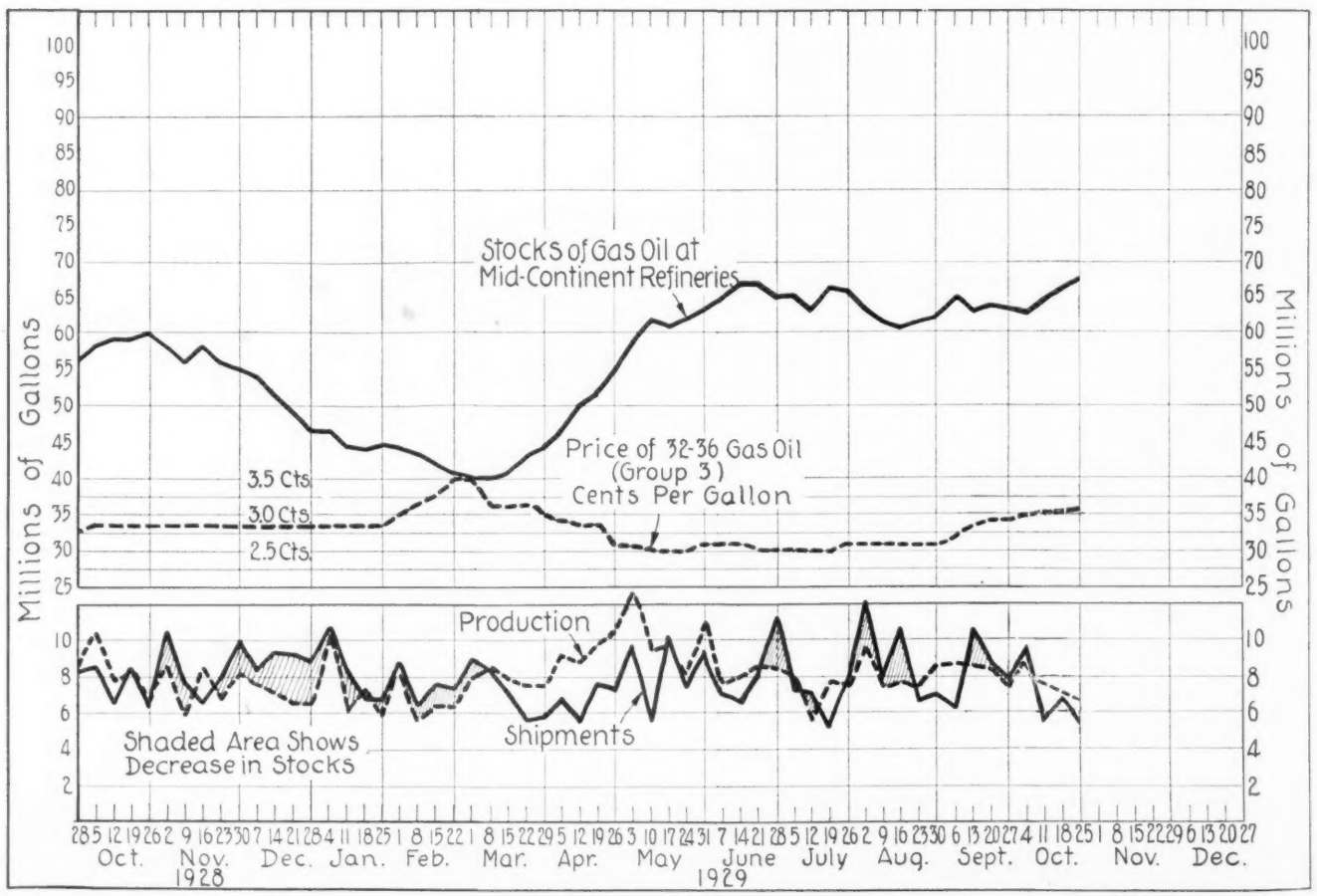
Lump	$4.50 – 5.00	$4.50 – 5.00	$4.50 – 5.00
Still run	$3.00	$3.00	$3.00
Breeze	$2.00	$2.00	$2.00

**Represents Both Sales and Quotations.

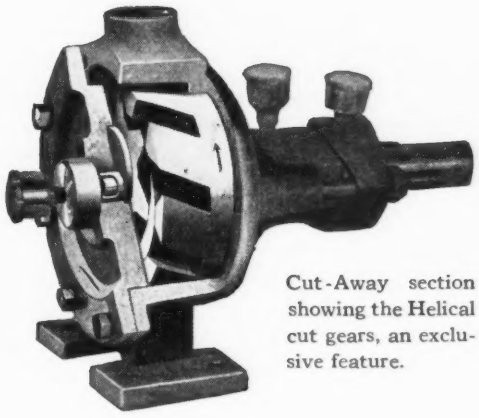
Barometer of Mid-Continent Refinery Market—Week Ending October 25

Charted Course of Prices, Production, Shipments, Stocks of Principal Refined Products, Week by Week, From Reports Made by 93 Plants to National Petroleum News


Millions of Gallons
Stocks of Stove Distillate at Mid-Continent Refineries
4.0 Cts.
3.5 Cts.
3.0 Cts.
Price of 38-40 Straw Distillate (Group 3) Cents Per Gallons
Shaded Area Shows Decrease in Stocks
Production
Shipments
Oct. Nov. Dec Jan. Feb. Mar. Apr May June July Aug. Sept. Oct. Nov. Dec
1928
1929


Millions of Gallons
Stocks of Gas Oil at Mid-Continent Refineries
3.5 Cts.
3.0 Cts.
2.5 Cts.
Price of 32-36 Gas Oil (Group 3) Cents Per Gallon
Production
Shipments
Shaded Area Shows Decrease in Stocks
Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
1928
1929

Why Helical Gears in a Rotary Pump?



Cut-Away section showing the Helical cut gears, an exclusive feature.

IT is very generally accepted that a rotary pump is preferable to a reciprocating pump for transferring large quantities of liquids at low power cost. In a reciprocating (piston type) pump it takes extra power to start the load at the beginning of each piston stroke. In a rotary pump when the liquid is started it is carried around a part of a circle. There is no stopping and starting but an even continuous flow. It is easy to understand why it takes less power and every mechanic understands, too, that a non-fluctuating load saves the motor.

The Perfection is the only rotary pump in which the Helical gear principle is embodied. The pump mechanism is extremely simple, with only two moving parts, the helical internal gear rotor and the helical idler gear or pinion. The teeth in the idler pinion intermeshing with the teeth in the rotor act like a series of pistons in rotating cylinders, sucking the liquid in the intake opening on the side, carrying it around and discharging it through the outlet at the top. (See cut-away illustration).

THE Helical shape of the gears prevents back lash and is preferable to the spur gear because it runs more quietly and smoothly. With helical gears there is not the shocking action and strain on the pump that is produced by the straight-on mesh of spur gears. The teeth of the Rotor in the Perfection Pump cut through the liquid on an angle with a shearing cut instead of head on.

The Perfection Rotary Pump is made in sizes from 3 to 90 gallons per minute. It is ideal for unloading oil or gas. Replace your old unloading pump with a Perfection. It will save you time, money and power, and will give you satisfactory service.

Write for Bulletin No. 271 and prices. The Perfection Rotary Pump has some special features that are well worth looking into.

Perfection Manufacturing Company

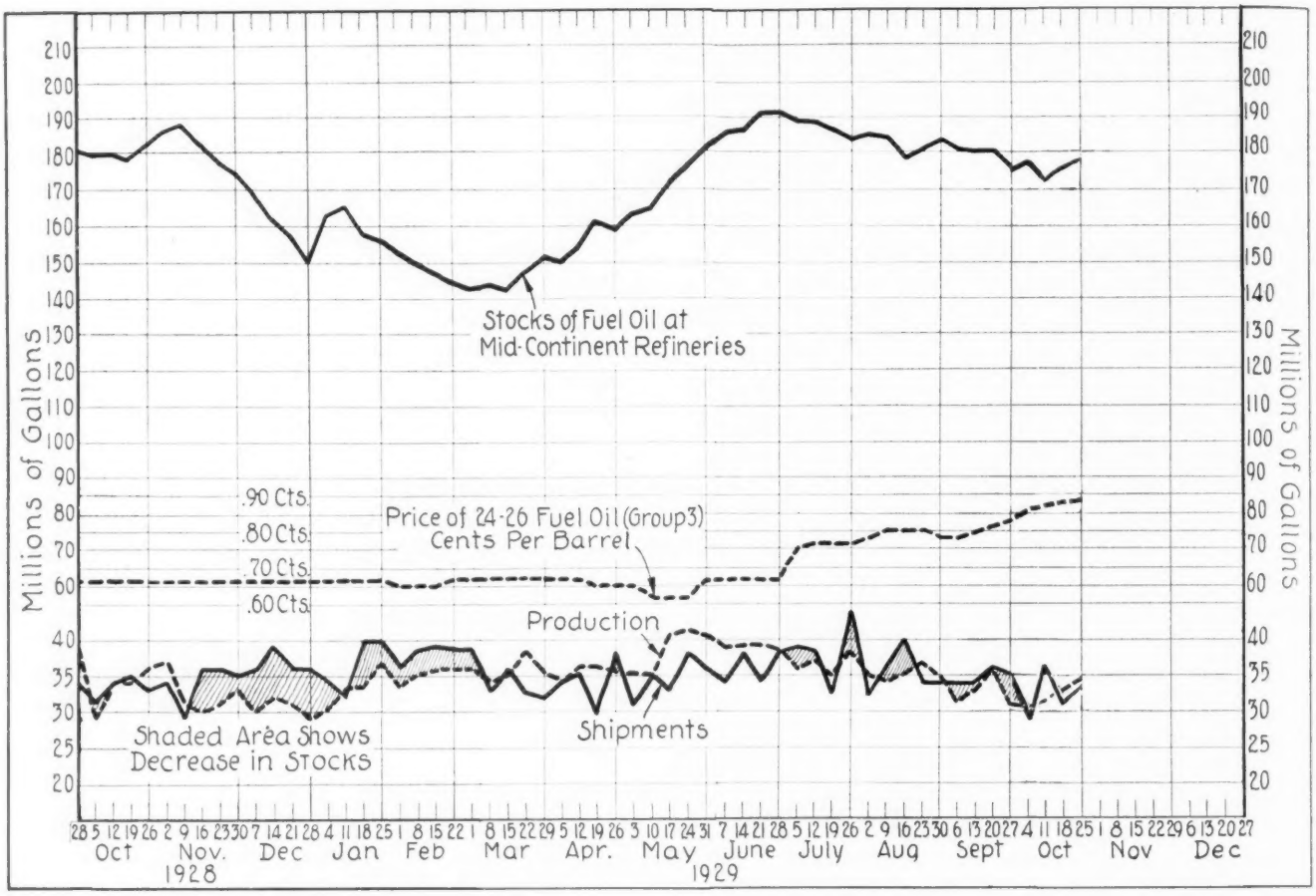
2194 East Hennepin Avenue,
Minneapolis, Minn.

Type 6—A Twin Gear Drive unloading Pump with Motor.

PERFECTION
ROTARY PUMPS

Barometer of Mid-Continent Refinery Market—Week Ending October 25

Charted Course of Prices, Production, Shipments, Stocks of Principal Refined Products, Week by Week, From Reports Made by 93 Plants in National Petroleum News


Millions of Gallons
Millions of Gallons
Stocks of Fuel Oil at Mid-Continent Refineries
.90 Cts.
.80 Cts.
.70 Cts.
.60 Cts.
Price of 24-26 Fuel Oil (Group 3) Cents Per Barrel
Production
Shipments
Shaded Area Shows Decrease in Stocks
Oct Nov. Dec Jan Feb Mar Apr. May June July Aug Sept Oct Nov Dec
1928
1929

California Refinery Market

Prices Drop Slightly After Crude Cut

LOS ANGELES, Oct. 24

ALTHOUGH crude oil is selling in four of California's flush fields at little more per barrel than the price of good fuel oil, there has been no apparent break in either the export or domestic markets.

With the announcements by Standard Oil Co. of California that the crude oil price at Santa Fe Springs, Seal Beach, and Signal Hill would be cut and a later announcement by Union Oil Co. that the price of crude oil at Ventura would be reduced it became evident that a number of small refineries could begin to make an abundance of gasoline and that the markets might suffer as a result.

The reduction at Santa Fe Springs averaged between $0.70 and $0.75 per barrel; at Signal Hill, $0.50 to $0.60 per barrel; Seal Beach approximately $0.50 per barrel; and at Ventura $0.50 to $0.60 per barrel.

Unless the cut in crude remains effective for any length of time, that is over a month, major marketing officials expect to prevent any drastic decrease in quotations for refined products. The majority of independent refiners are content to keep the profit resulting from 40 and 60 cent crude in their pockets, and therefore will not be as anxious to undersell the other fellow.

The menace of overflowing tanks still stares the California marketer in the face and until an agreement is reached among operators in the flush fields whereby production is curtailed at least 200,000 barrels daily average it is not expected that the posted price of crude in these fields will be advanced. In fact if production is not materially and promptly reduced, prices comparable with those at the aforementioned fields will be inaugurated in other California fields such as Elwood, for example.

U. S. Motor for export showed the only weakness in the export market as refiners dropped their quotations to 6.25 cents in answer to a number of inquiries. Several smaller refiners have their storage facilities full and would welcome a chance to unload at 6.25 cents. It was thought that a cargo could be purchased for as low as 6 cents or even 5.875 cents on firm offer.

In the domestic tank car market gasoline for shipment out of the state was active but prices obtained were low. Quotations on gasoline for consumption outside of the state ranged from 7 to 8 cents and one or two dealers reported they had sold a few cars under 7 cents.

The effect of any surplus of gasoline resulting from the lower price of crude is expected to be felt first in the out-of-state market. While the instate market may be held under a fairly tight rein for a few weeks at least there is practically no control over the out-of-state jobbers, according to reports.

Fuel oil prices suffered a further setback from the cut in crude. Spot sales were reported as low as $0.40 per barrel.

Pennsylvania Market

Better Demand For Neutral Oils

CLEVELAND, Oct. 28.—Increased demand for neutral oils together with a continued good demand for kerosene and fuel oil supplied most of the activity in western Pennsylvania markets during the week ended Oct. 26.

Gasoline, cylinder stocks and bright stocks for prompt shipment were generally unchanged. The trends of prices for these commodities for deferred shipments were somewhat mixed. Wax was active and prices advanced 0.125 to 0.25 cent.

As a result of the considerably better demand for neutral oils, there was some talk among the trade of advancing prices. The feeling in some quarters, however, was that in view of the present large stocks of neutrals, any attempt to raise prices would be untimely.

It was agreed that the better demand had checked the downward movement in prices which has been under way for several weeks past. Low cold test neutrals were getting better play. One refiner said he was having a hard time keeping up with orders.

Kerosene, 45 water white, moved up to a minimum of 6.875 cents against a minimum of 6.625 cents quoted a week ago. Several refiners quoted 7.25 cents for this grade Oct. 26 and some reported sales at this figure. The better grades of kerosene moved proportionately higher.

The call from refiners for 36-40 fuel oil for cracking was reported fairly consistent but most sellers said the excellent demand from domestic burning oil distributors accounted more for the 0.125 to 0.25 cent advance in prices. Demand for the lower gravity fuels, 30-34 and 28-32, was equally as good; these grades were relatively scarce.

Steam refined stock, filterable 600, was rather freely offered last week at around 27 cents for spot shipment. This oil was reported available only in limited quantities for shipment over November at 27 cents and many refiners were quoting higher prices, ranging up to 30 cents.

Bright stock continued to be more freely offered although the low quotation for No. 8 color remained at 51 cents. No. 6 to 6½ color diluted was offered by more sellers at 50 cents. Some shading of the foregoing prices was reported.

There was an active demand for white crude scale from eastern seaboard resale agents. Prices for both the 122-124 and 124-126 A.m.p. grades were higher by 0.125 to 0.25-cent. Most sellers were asking 3.50 cents for both grades.

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DYKEM GREEN N
DYKEM GREEN YN
DYKEM GREEN GN
DYKEM GREEN MY

Green is an attractive and pleasing color for gasoline and you can have individuality in one of its shades—varying from a deep SEA GREEN to a bright EMERALD GREEN.

Write for price and samples of shades preferred.

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Rockford, Illinois

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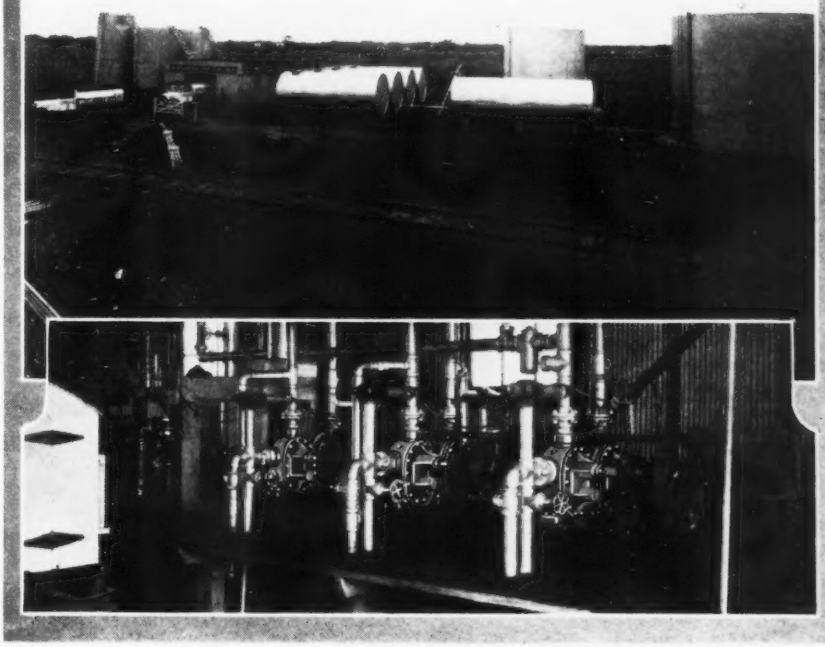
Gasoline and Oil PUMPS



Eastern Domestic Markets

New England Gasoline Prices Lower

Staff Special
NEW YORK, Oct. 26

U. S. MOTOR gasoline prices were 0.25 cent lower at New York and in New England the past week. Prices at other points were unchanged and demand was good. Burning oils were in better demand although prices were unchanged.

The price for U. S. Motor gasoline at New York was lowered to 8.75 cents early in the week, despite the fact that one or two sellers were talking of advancing their prices. The range the week before was from 8.75 to 9 cents. In drawing away from the top price there was no particular indication of a weaker market expressed, the trade reported; it was merely a leveling out of prices.

New England quotations were down to 10.25 cents delivered, at both Boston and Providence, and 10.75 cents at Portland. When the general advance occurred at those points some two weeks ago, one company did not make the raise and the decline the past week was to bring quotations in line with that company's prices.

The demand for gasoline at all points was good the trade reported. At New York in particular, several of the trade said their shipments were above what they expected and they were inclined to believe there would be little variation in prices over November. As far as could be learned no quotations were made for November the past week, nor were any sought.

The price at Philadelphia remained at 9 cents and the trade there reported orders numerous. At Baltimore there was some shading reported at the close of the week. It was said that some gasoline had moved at 8.75 cents although it was impossible to trace the sales. Sellers were quoting 9.25 cents for California gasoline for nearby shipment and 9 cents to outlying districts. U. S. Motor was quoted at 9 cents flat.

At other points on the coast, prices were at 9 cents and there were no reports of shading. The spot buying was not heavy, however, as most of the goods in those districts moves on contract. The trade said that orders were normal.

Stocks of gasoline on the east coast are favorable, the trade reported. For the past three weeks a principal refiner has been buying gasoline on the outside to take care of his regular customers. Two other refiners, also made outside purchases the past week. One Baltimore seller's stocks of California gasoline were low through the delay of a boat. He said he did not expect to have his tanks filled before the end of next week.

In commenting on the cut in California crude oil prices Oct. 21, the trade reported that no decline was expected in refined oil prices on the west coast. They felt the reduction was made solely to aid the gas conservation law and that prices might increase instead of decrease, due to the anticipated curtailment of production.

Various reports were heard of the price of California goods on the west coast. There was a report early in the week that two cargoes had been sold at 6 cents, f. o. b. California ports. However, the sale could not be traced definitely, and several eastern distributors of California gasoline were dubious about it having been made. Prices were being quoted up to 6.50 cents, f.o.b. California and one sale was made during the week at 8.625 cents, c.i.f. New York. It was reported that the price f.o.b. California was higher than the delivered price would indicate, as the buyer was able to take advantage of a good boat rate.

Inter-coastal tanker rates on clean boats were again higher at the end of the week. It was reported that one charter had been fixed at $1.00 per barrel over the coming year. The price seemed rather high and several of the trade were inclined to doubt it. For immediate movement the price would not appear so high but it seemed out of line for the entire year when one boat had been chartered at $0.90 and another at $0.93. Ninety-eight cents for a single trip has been paid recently, although owners were asking up to $1.10.

Eastern burning oil markets picked up during the past week although prices were unchanged. Suppliers reported a heavy demand for gas oil particularly from Connecticut and upper New York state.

Gulf Coast Markets

Grade "C" Bunker Oil Reported Lower

Staff Special
NEW YORK, Oct. 26

GULF markets were devoid of interest the past week. There were no inquiries in the market, no sales were reported made, and prices of all commodities were unchanged.

There was some talk, however, of lower Grade C bunker oil prices in cargo lots. Toward the latter part of the week the report was heard that $0.70, the low range of quotations, was being shaded and that some goods had moved as low as $0.65. It was impossible to learn the principals of the transaction. Virtually all sellers were quoting from $0.70 to $0.75 cents f.o.b. Gulf terminals.

Some of the trade were inclined to believe that $0.70 might be shaded inasmuch as some buyers do business on a gravity basis and will pay more for higher gravity than low gravity goods. Usually gravity is not a great factor, the heat producing quality of the oil determining the price instead.

Gas oil prices were unchanged although several sellers reported the market was tending upward. High sulfur goods was selling close to 4 cents, the low of the range for low sulfur goods, and some traders expected to see the better grades advance.

Tanker markets were much the same as the week before although there was a decline of from one to three shillings in clean rates from north Atlantic ports to the Continent. Rates the past week were from 23 to 25 shillings per long ton whereas a week ago clean boats were quoted at 26 shillings flat.

There was considerable discussion among the trade about the heavy export buying in the Mid-Continent the past week. The New York trade generally knew nothing of the business until the purchases had been made.

The goods was purchased, according to reports, at 7.75 cents for 64-66, 375 end point gasoline and 7.50 cents for 64-66, 390 end point gasoline. Between 16 and 18 million gallons of the two grades were bought. Those prices figure from 0.25 to 0.375 cent below the postings at the Gulf of the Export Petroleum Association.

Commodities for domestic shipment from the Gulf also were unchanged in price. Kerosene which has sold at 6.375 to 6.50 cents was expected to gain in price since quotations in the field were slightly higher. There have been no sales of gasoline or gas oil for some time past, and quotations were largely based on those in the field.

Wax Markets

White Crude Scale Unchanged

NEW YORK, Oct. 26.—Wax markets were generally unchanged over a week ago although there were some price revisions—both upward and downward—for some grades of fully refined. Demand for scale waxes continued spotty and there was very little interest shown for fully refined grades.

The trade reported revised prices on 125-127 A.m.p., 128-130 A.m.p. and 133-135 A.m.p. The first grade was up 0.25 cent to 4.25 cents, the second also was up 0.25 cent to 4.50 cents while 133-135 A.m.p. was generally quoted 0.25 cent lower at 5.75 to 6 cents.

The upward trend was not caused by additional business, the trade reported, but rather because of the advance in scale prices two weeks ago. Stocks of 125-127 A.m.p. were light several of the trade believed, and one company who was virtually sold up on that grade was quoting higher than 4.25 cents to divert other than its regular customers to other sellers.

Although the price for 123-125 A.m.p. was unchanged at 4 to 4.25 cents, several of the trade said the market was improving and that there was less of the 4-cent goods available. Four cents could still be done at the close of the week for small orders, but most sellers were unwilling to quote less than 4.125 cents on large volume business and some of them were asking 4.25 cents.

The trade believed that fully refined prices would be higher in the next few weeks. They based their opinions on the fact that foreign buyers, who purchased large quantities last year for storage, were believed to be running low. One of the largest wax exporters on the east coast said his foreign company's stocks were low and that it had already made a few spot purchases through the parent company. He expected the subsidiary company to be in the market for next year's requirements in a few weeks.

Several sales and inquiries were reported for white crude scale, most of them for small lots as has been the case the past two or three weeks. One firm sold 50 tons of 124-126 A.m.p. for shipment to South America at 3.375 cents, f.a.s. the U. S. Gulf. Two 20-ton lots were sold for domestic shipment at 3.375 cents. One company reported small inquiries from Peru, Colombia and the United Kingdom, all for white crude scale.

Prices for yellow scale were unchanged at 3.25 to 3.375 cents with very little business reported placed. However, no shading of those prices was reported.

Skilled Supervision
Guarantees the Quality of
Gulf Products

COASTAL AND PARAFFINE CRUDES
GASOLINE — LUBRICATING OILS
NAPHTHA — GAS — OILS
WAX — PETROLEUM COKE
CYLINDER—ENGINE—CORDAGE

Gulf Refining Company

General Sales Offices
PITTSBURGH, PA.

District Sales Offices
New York, Boston, Philadelphia, Louisville, Atlanta, Houston, New Orleans

STEEL
DRUM ACCESSORIES
CORPORATION

BUFFALO, NEW YORK

"The House of Drum Faucets"

Complete Seaboard Market

(Export Markets for whole year given in OIL PRICE HANDBOOK. Each volume carries refinery, tank wagon, crude and export markets—complete for the whole year)

Eastern Domestic Market

(Prices for tank car lots, f. o. b. refinery or seaboard terminal, representing majority of quotations.)

U. S. MOTOR GASOLINE	Oct. 28	Oct. 21	Oct. 14
New York harbor	8.75	8.75 – 9.00	8.75 – 9.00
Portland district	††10.75	*11.00	*11.00
Boston district	††10.25	*10.50	*10.50
Providence district	††10.25	*10.50	*10.50
Philadelphia district	9.00	9.00	9.00
Baltimore district	9.00	9.00	9.00
Norfolk district	9.00	9.00	9.00
Charleston district	9.00	9.00	9.00
Savannah district	9.00	9.00	9.00
Jacksonville district	9.00	9.00	9.00
CALIFORNIA, U. S. MOTOR GASOLINE			
New York harbor	9.00	9.00	9.00
Philadelphia district	9.00	9.00	9.00
Baltimore district	9.00 – 9.25	9.00 – 9.25	9.00 – 9.25
WATER WHITE KEROSENE			
New York harbor	7.75	7.75	7.75
Philadelphia district	7.75	7.75	7.75
Baltimore district	7.75	7.75	7.75
GAS OIL: 28-34 Gravity			
New York harbor	4.75	4.75	4.75
Boston district	4.75	4.75	4.75
FURNACE OIL: 36-40 Gravity			
New York harbor	6.00 – 6.50	6.00 – 6.50	6.00 – 6.50
Boston district	6.00 – 6.50	6.00 – 6.50	6.00 – 6.50
GRADE C BUNKER OIL†			
New York harbor	$1.05	$1.05	$1.05
Boston district	$1.05	$1.05	$1.05
DIESEL OIL			
New York harbor	$2.00 –$2.10	$2.00 –$2.10	$2.00 –$2.10
MEDICINAL OILS, RUSSIAN			
.885-890 s.g. 320-330 vis.	$0.82 – 0.97	$0.82 – 0.97	$0.82 – 0.97
.870-875 s.g. 145-155 vis.	$0.74 – 0.89	$0.74 – 0.89	$0.74 – 0.89

Note: Above gasoline prices do not include inspection tax levied in some states *Nominal and Minimum delivered. **Delivered prices. †Lighterage 5c per bbl. additional. ††Minimum delivered.

New York Export Market

(Lubricating oils are per gal. in bbls.)

	Oct. 28	Oct. 21	Oct. 14
CYLINDER OILS (Pennsylvania Products)			
Bright stock, dark	56.00 –58.00	57.00 –60.00	57.00 –60.00
600 D filtered	44.00 –46.00	45.00 –46.00	41.00 –46.00
600 Warren E filtered	39.00 –41.00	40.00 –41.00	40.00 –41.00
600 s.r. unfiltered	33.00 –35.00	32.00 –35.00	31.00 –33.00
650 s.r. unfiltered	38.00 –40.00	37.00 –39.00	37.00 –38.00
600 flash, s.r.	40.00 –42.00	39.00 –41.00	39.00 –41.00
630 flash, s.r.	43.00 –45.00	43.00 –45.00	43.00 –45.00
RED ENGINE OILS (Vis. 100°)			
300 vis. No. 6½ color	20.00 –21.00	20.00 –21.00	20.00 –21.00
250 vis. No. 6 color	18.00 –20.00	18.00 –20.00	18.00 –20.00
200 vis. No. 6 color	16.00 –17.00	16.00 –17.00	16.00 –17.00
PALE ENGINE OILS (Vis. 100°)			
230 vis. No. 3¾ color	21.00 –22.00	21.00 –22.00	21.00 –22.00
180 vis. No. 3¼ color	17.00 –18.00	17.00 –18.00	17.00 –18.00
100 vis. No. 2¼ color	16.00	16.00	16.00
MOTOR OILS (Vis 100°)			
600 vis. No. 7 color	30.00 –32.00	30.00 –32.00	30.00 –32.00
500 vis. No. 6½ color	28.00 –29.00	28.00 –29.00	28.00 –29.00
400 vis. No. 7¼ color	26.00 –27.00	26.00 –27.00	26.00 –27.00
300 vis. No. 6 color	23.00 –24.00	23.00 –24.00	23.00 –24.00
200 vis. No. 6 color	21.00 –22.00	21.00 –22.00	21.00 –22.00
MEDICINAL OILS			
.875-880 s.g.	$0.76 – 0.91	$0.76 – 0.91	$0.76 – 0.91
.860-.865 s.g.	$0.58 – 0.73	$0.58 – 0.73	$0.58 – 0.73
WAXES (In cents per pound, f.a.s. carload lots)			
WHITE CRUDE SCALE (In barrels)			
122-124 A.m.p.	3.375– 3.50	3.375– 3.50	3.375– 3.50
124-126 A.m.p.	3.375– 3.50	3.375– 3.50	3.375– 3.50
FULLY REFINED (In burlap bags)			
123-125 A.m.p. Phila.	4.00 – 4.25	4.00 – 4.25	4.00 – 4.25
125-127 A.m.p.	4.25	4.00 – 4.25	4.00 – 4.25
128-130 A.m.p.	4.50	4.25 – 4.50	4.25 – 4.50
130-132 A.m.p.	5.00 – 5.25	5.00 – 5.25	5.25 – 5.50
133-135 A.m.p.	5.75 – 6.00	6.00	6.00
135-137 A.m.p.	6.25	6.25	6.25
YELLOW CRUDE SCALE			
24-126 A.m.p.	3.25 – 3.375	3.25 – 3.375	3.25 – 3.375

Gulf Export Market

(Prices are f. o. b. Gulf oil terminals in Texas and Louisiana, shipments of 20,000 bbls. or more unless otherwise noted and for export shipment only).

GASOLINE	Oct. 28	Oct. 21	Oct. 14
U. S. Motor	8.50	8.50	8.50
60-62, 400 e.p.	9.50	9.50	9.50
61-63, 390 e.p.	9.75	9.75	9.75
64-66, 375 e.p.	10.00	10.00	10.00
U. S. Motor, cases (cargoes)	$1.85	$1.85	$1.85
64-66, cases (cargoes)	$2.00	$2.00	$2.00
KEROSENE			
44 water white	8.00	8.00	8.00
41-43 prime white	7.00	7.00	7.00
Water white, cases (cargoes)	$1.80	$1.80	$1.80
Prime white, cases (cargoes)	$1.70	$1.70	$1.70
DOMESTIC GAS & BUNKER OILS			
*26-30 translucent gas oil	4.00	4.00	4.00
*30 plus translucent gas oil	4.00 – 4.25	4.00 – 4.25	4.00 – 4.25
Grade C bunker oil	$0.95	$0.95	$0.95
Grade C bunker oil, cargoes	$0.70 –$0.75	$0.70 –$0.75	$0.70 –$0.75
*Less than ½ of 1% sulphur.			
MEXICAN CRUDE AND BUNKER OILS (F. O. B. Steamer, Tampico)			
Heavy Panuco crude taxes to be paid	$0.60 –$0.65	$0.60 –$0.65	$0.60 –$0.65
Grade C bunker oil for bunkering purposes, taxes paid	$0.90 –$0.95	$0.90 –$0.95	$0.90 –$0.95
SOUTH TEXAS LUBRICATING OILS, (Viscosity at 100°F.) (cold test) (Tanker, f. o. b. Houston)			
100 vis. No. 2 unfiltered pale	6.25 – 6.50	6.25 – 6.50	6.25 – 6.50
200 vis. No. 3 unfiltered pale	8.25 – 9.00	8.25 – 9.00	8.25 – 9.00
300 vis. No. 3 unfiltered pale	9.75 –10.00	9.75 –10.00	9.75 –10.00
500 vis. No. 3½ unfiltered pale	11.25 –11.50	11.25 –11.50	11.25 –11.50
750 vis. No. 4 unfiltered pale	12.75 –13.00	12.75 –13.00	12.75 –13.00
1200 vis. No. 5 unfiltered pale	16.25 –16.50	16.25 –16.50	16.25 –16.50
200 vis. No. 5-6 red oil	8.00	8.00	8.00
300 vis. No. 5-6 Red oil	8.50	8.50	8.50
500 vis. No. 5-6 red oil	9.25 –10.00	9.25 –10.00	9.25 –10.00
750 vis. No. 5-6 red oil	12.00	12.00	12.00
1200 vis. No. 5-6 red oil	16.25 –16.50	16.25 –16.50	16.25 –16.50

Gulf Domestic Market

(Prices are f.o.b. Gulf oil terminals in Texas and Louisiana in shipment of 20,000 bbls. or more, representing sellers' opinions, for domestic shipment only).

	Oct. 28	Oct. 21	Oct. 14
U. S. Motor gasoline	7.50	7.50	7.50
41-43 w.w. kerosene	6.375– 6.50	6.375– 6.50	6.50 – 6.625
*26-32 translucent gas oil	4.00 – 4.125	4.00 – 4.125	4.00 – 4.125
*Less than ½ of 1% sulphur.			

Pacific Export Market

(Quotations are at seaboard, Los Angeles, in cargo lots, cents per gallon, except where otherwise noted.)

	Oct. 28	Oct. 21	Oct. 14
Gasoline, U. S. Motor, 53-55 Gravity	6.25 – 7.25	6.75 – 7.25	6.75 – 7.25
Gasoline, U. S. Motor-blends and special cuts	7.25 –10.00	7.50 –10.00	7.50 –10.00
Gas Oil, 30-34, per barrel	$0.85 –$1.05	$0.85 –$1.05	$0.90 –$1.05
Diesel Oil, 27 plus, per barrel	$0.85 –$1.00	$0.85 –$1.00	$0.875–$1.00
Bunker oil, 14-18, per barrel	$0.70 –$0.85	$0.70 –$0.85	$0.70 –$0.85
Fuel oil, 14-18 per barrel	$0.60 –$0.85	$0.60 –$0.85	$0.60 –$0.85
Kerosene, 38-40 w.w., 125-150 flash, per gal.	5.75 – 6.25	5.75 – 6.25	5.75 – 6.25
Cased Goods			
Gasoline, U. S. Motor	$1.75 –$1.85	$1.75 –$1.85	$1.75 –$1.85
Kerosene, 38-40 w.w., 125, 150 flash	$1.45 –$1.50	$1.45 –$1.50	$1.45 –$1.50

Tanker Rates

(Approximate tanker freight rates to Continental ports, in shillings per ton of 2240 pounds, British sterling; to American ports, cents per barrel.)

	Oct. 28 Crude &/or Fuel	Refined Oil &/or Spirits
Calif. to U. K. or Continental ports*	35	43
Gulf to U. K. or Continental ports*	22–23	29–30
North Atlantic to U. K. or Continental ports*	19–20	27–29
Calif. to North Atlantic ports (not E. of N. Y.)	$1.10	$1.00–$1.05
Gulf to North Atlantic ports (not E. of N. Y.)**	43	42

*Continental ports in the range between Bordeaux and Hamburg, both inclusive.

**Venezuela loading same rate. For Tampico 3c per bbl. additional.

Absolute Burglar Protection

At Low Cost

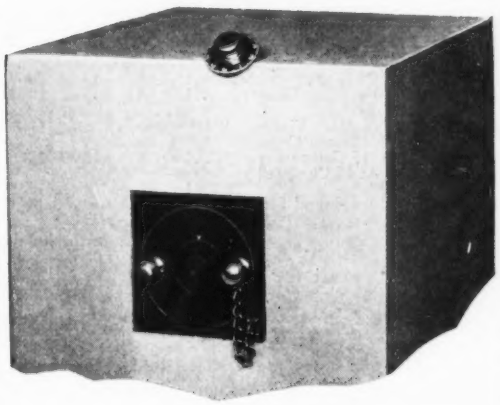
First Public Offering of

SPECIAL "NATIONAL" CHESTS

ONLY $37.50 Each

Discounts in Quantities
Express prepaid anywhere in U. S. A.

Ready to install in concrete block. Complete drawing and specification furnished for easy installation.



Already installed by THE STANDARD OIL CO. OF INDIANA in nearly a Thousand of their Stations in Chicago, Milwaukee, Kansas City, St. Louis and Indianapolis.

Months were spent designing this chest to not only withstand any form of attack but to make repair cost after attack trivial. Before purchasing these chests The Standard Oil Co. submitted it to every form of destructive test in their laboratories. Numberless attacks have already been successfuly resisted since installation.

Order Now With Confidence

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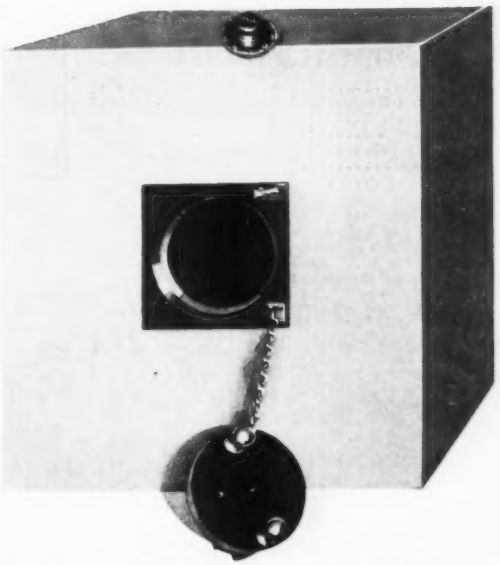
Every National product embodies the highest type construction and workmanship and we unhesitatingly accept orders with the understanding that if for any reason they do not please the purchaser in every way they may be returned with full credit and all expense to be paid by us.



Views of chest installed in concrete block, showing door closed with dial removed, and chest open ready for use.

Read These Six Features Then Act

1. Absolute protection at small cost.
2. Removable dial discourages sledging.
3. Yale lock with special graduated spindle flush with door.
4. Immediate access after attack without services of expert.
5. Repair parts at trivial cost.
6. Eliminates the necessity of high priced insurance.

ESTABLISHED 1883—44 YEARS AGO

THE NATIONAL SAFE AND Lock Company

GENERAL OFFICES—2345 EAST 69th STREET
WORKS—EAST 69th to 70th ST. AND PENNSYLVANIA R. R.

CLEVELAND, U. S. A.

Mail Today

Check Service Desired

THE NATIONAL SAFE & LOCK CO.
2345 East 69th St., Cleveland, Ohio

☐ Enclosed please find my check for.....National Chests. It is understood that if they do not satisfy for any reason they may be returned with full credit.

☐ Please send me further information on the protection offered by National Chests.

Name.....

Address.....

City..... State.....

Tank Wagon Service Station Markets for Gasoline and Kerosene

(OIL PRICE HANDBOOK has t. w. and s. s. markets for a whole year, arranged for quick reference)

These Prices in Effect Oct. 28, 1929, as Posted by Principal Marketing Companies

S.O. NEW JERSEY TERRITORY

	Gasoline T.W.	Tax	Total T.W.	S.S.	Oil T.W.
Atlantic City, N. J.	14	2	16	18	13
Newark, N. J.	15	2	17	19	13
Annapolis, Md.	16	4	20	22	13
Baltimore, Md.	15	4	19	21	12
Cumberland, Md.	16	4	20	22	13
Washington, D. C.	15	2	17	19	12
Danville, Va.	16	5	21	23	12
Norfolk, Va.	15	5	20	22	13
Richmond, Va.	15	5	20	22	13
Roanoke, Va.	15	5	20	21	13
Petersburg, Va.	16	5	21	23	13
Charleston, W. Va.	15	4	19	21	13
Keyser, W. Va.	16	4	20	22	13
Parkersburg, W. Va.	15	4	19	21	12
Wheeling, W. Va.	16	4	20	22	13
Charlotte, N. C.	16	5	21	23	13
Hickory, N. C.	16	5	21	23	13
Mt. Airy, N. C.	16	5	21	23	13
Salisbury, N. C.	16	5	21	23	13
Charleston, S. C.	15	6	21	23	13
Columbia, S. C.	16	6	22	24	13

Note: 2c per gallon discount off t.w. price of gasoline to dealers and commercial consumers thru S. O. New Jersey territory.

CONTINENTAL OIL

Denver, Colo.	14	4	18	21	15.5
Pueblo, Colo.	14	4	18	21	15.5
Grand Junc., Colo.	18.5	4	22.5	25.5	19
Casper, Wyo.	16	4	20	23	14
Cheyenne, Wyo.	17	4	21	24	15.5
Butte, Mont.	20.5	5	25.5	28.5	20
Helena, Mont.	20.5	5	25.5	28.5	20
Salt Lake City, Utah	17.5	3½	21	24	17
Boise, Ida.	19.5	4	23.5	26.5	19
Twin Falls, Ida.	19.5	4	23.5	27.5	19
Albuquerque, N. M.	16	5	21	24	17

S. O. CALIFORNIA

Phoenix, Ariz.	14	4	18	22	20.5
Los Angeles, Cal.	16.5	3	19.5	22.5	15.5
Fresno, Cal.	17	3	20	23	17
San Francisco, Cal.	17	3	20	23	15.5
Reno, Nev.	21	4	25	28	19
Portland, Ore.	17.5	3	20.5	23.5	16.5
Seattle, Wash.	17.5	3	20.5	23.5	16.5
Spokane, Wash.	21.5	3	24.5	27.5	20.5
Tacoma, Wash.	17.5	3	20.5	23.5	16.5

Note: 4c per gal. discount to dealers off t.w. price of gasoline to customers taking tank truck delivery, thru S. O. California territory except 1c discount at Phoenix to dealers only.

S. O. LOUISIANA

Little Rock, Ark.	14	5	19	21	13
Alexandria, La.	‡15	4	19	21	†16
Baton Rouge, La.	14	4	18	20	†14.5
Lake Charles, La.	††16.5	4	††20.5	††22.5	†16
New Orleans, La.	*11	4	*15	15	†13
Shreveport, La.	15.5	4	19.5	21.5	†15
Lafayette, La.	**16	4	**20	**22	†14
Bristol, Tenn.	16	5	21	22	14
Chattanooga, Tenn.	15	5	20	20	14
Knoxville, Tenn.	15	5	18	20	16
Nashville, Tenn.	14	5	19	19	16
Memphis, Tenn.	15	5	20	22	12.5

Note: 2c per gallon discount off t.w. price of gasoline to dealers thru S. O. Louisiana territory.

*New Orleans gasoline prices include 1c parish tax in addition to 4c state tax, and kerosene prices include 1c state tax and 1c parish tax.

†Kerosene price in Louisiana includes 1c state tax.

**Lafayette gasoline prices include 1c parish tax in addition to 4c state tax.

††Lake Charles gasoline prices include 1c parish tax.

S. O. KENTUCKY

Ashland, Ky.	13	5	18	19	15.5
Catlettsburg, Ky.	13	5	18	19	15.5
Lexington, Ky.	15	5	20	22	15.5
Louisville, Ky.	16	5	21	23	15
Covington, Ky.	15	5	20	21	15.5
Clarksdale, Miss.	13	5	18	20	12.5
Gulfport, Miss.††	17.5	5	22.5	24.5	14
Jackson, Miss.	16	5	21	23	13
Natchez, Miss.	15.5	5	20.5	20.5	14
Vicksburg, Miss.	15.5	5	20.5	22.5	14
Birmingham, Ala.	15	4	19	21	13
Mobile, Ala.‡	16	4	20	22	15
Montgomery, Ala.*	17	4	21	23	16.5

Latest Changes in Tank Wagon Prices

Gasoline Changes

S. O. Louisiana—T. w. and s. s. cut 2c, Little Rock, to 19c and 21c, respectively, including 5c tax, **Oct. 19.**

S.s. cut 2c, Chattanooga, to 20c, t. w. remaining unchanged at 20c, **Oct. 20.**

T. W. cut 2c, Knoxville, to 18c, s. s. remaining unchanged at 20c, **Oct. 21.**

S. s. cut 2c, New Orleans, to 15c, t. w. remaining unchanged at 15c, **Oct. 26.**

S. O. Kentucky—T.w. and s.s. cut 1c, Covington, to 20c and 21c, respectively, including 5c tax, **Oct. 22.**

S. O. Ohio—T. w. cut 1c, s. s. 2c, Meeker, both to 18c, assuming the state wide structure, **Oct. 17.**

T. w. cut 1c, s. s. 2c, Ney, both to 18c, assuming the state wide structure, **Oct. 24.**

T. w. and s. s. both cut 1c, Midway to 18c and 19c, **Oct. 24.**

Magnolia Petroleum—T. w. and s. s. cut 2c, San Antonio, to 15c and 19c, respectively, including 4c tax, **Oct. 24.**

	Gasoline T.W.	Tax	Total T.W.	S.S.	Oil T.W.
Atlanta, Ga.	14	6	20	22	†16.5
Augusta, Ga.	14	6	20	22	†15.5
Macon, Ga.	17	6	23	25	†16.5
Savannah, Ga.	16	6	22	24	†15.5
Jacksonville, Fla.	16	6	22	24	14.5
Miami, Fla.	17	6	23	25	15.5
Tampa, Fla.	16	6	22	24	14.5
Pensacola, Fla.**	17	6	23	25	14.5

Note: Net price of gasoline to dealers is 2c under posted t.w. price thru S. O. Kentucky territory.

*Local privilege tax of 1 cent on gasoline and ½ cent on kerosene at Montgomery included. ‡Mobile gasoline prices include 1c city tax.

†Georgia kerosene prices include 1c state tax.

**Both tank wagon prices include 1c city tax at Pensacola which went into effect Oct. 15, 1926.

††Both tank wagon prices at Gulfport include Harrison county privilege tax of 2c.

S. O. NEBRASKA

Omaha, Neb.	16.25	4	20.25	22.25	13.25
McCook	17.75	4	21.75	23.75	14.75
Norfolk	16.75	4	20.75	22.75	13.75
North Platte	17.75	4	21.75	23.75	14.50
Scottsbluff	17.75	4	21.75	23.75	14.25

S. O. INDIANA

Chicago, Ill.	16	3	19	20	13
Decatur, Ill.	16.2	3	19.2	20.2	13.1
E. St. Louis, Ill.	15.4	3	18.4	17.4	12.2
Joliet, Ill.	16.4	3	19.4	20.4	13.3
Peoria, Ill.	16.2	3	19.2	20.2	13.1
Quincy, Ill.	16.2	3	19.2	20.2	12.9
Indianapolis, Ind.	16.2	4	20.2	21.2	14.2
Evansville, Ind.	16	4	20	21	14
South Bend, Ind.	16.4	4	20.4	21.4	14.4
Detroit, Mich.	16.8	3	19.8	20.8	14.7
Grand Rapids, Mich.	16.7	3	19.7	20.7	14.6
Saginaw, Mich.	16.9	3	19.9	20.9	14.8
Green Bay, Wisc.	16.6	2	18.6	19.6	13.4
Madison, Wisc.	16.3	2	18.3	17.3	13.1
Milwaukee, Wisc.	16.1	2	18.1	19.1	12.9
La Cross, Wisc.	17.2	2	19.2	20.2	14
Minneapolis, Minn.	17.2	3	20.2	21.2	13.9
Duluth, Minn.	17.5	3	20.5	21.5	13.9
Mankato, Minn.	17.1	3	20.1	21.1	13.7
Des Moines, Ia.	16.5	3	19.5	20.5	13.3
Davenport, Ia.	16.5	3	19.5	20.5	13.3
Sioux City, Ia.	16.1	3	19.1	20.1	12.9
Mason City, Ia.	16.5	3	19.5	20.5	13.3
St. Louis, Mo.	*15.9	2	17.9	18.9	12.3
Kansas City, Mo.	†16.9	2	18.9	19.9	11.6
St. Joseph, Mo.	†16.5	2	18.5	19.5	12.2
Fargo, N. D.	18.9	3	21.9	22.9	15.9
Grand Forks, N. D.	19.2	3	22.2	23.2	16.2
Minot, N. D.	18.9	3	21.9	22.9	15.9
Pierre, S. D.	17	4	21	22	14.4
Huron, S. D.	17.3	4	21.3	22.3	14.7
Wichita, Kans.	14.8	3	17.8	18.8	11.8
Bartlesville, Okla.	14.5	4	18.5	19.5	11.5

S. O. Indiana's quantity contract price schedule thru territory except Chicago on tank truck deliveries of gasoline, figured from the service station price, is 2c for 500 gals. or more a month; 2½c for 2000 gals. or more a month and 3c for 6000 gals. or more a month.

In Chicago and vicinity, these discounts apply. Over 500 gals. per month, 2c per gal. off service station price; over 1,000 gals. per month, 4c per gal. off service station price.

*Includes city tax of ½c.

†Includes city tax of 1c.

S. O. OHIO

Ohio state-wide.	15	4	19	20	13
Paulding County.	15	4	19	20	11
Belmont, Columbiana, Jackson, Meigs, Noble, Vinton, Washington, Monroe, Gallia and Jefferson Counties, & *15 Competitive Pts.	14	4	18	18	13
At †6 Competitive Points	14	4	18	19	13
Bryan and Findlay.	13	4	17	17	13

Note:—Discount to dealers and commercial accounts generally thru Ohio is 2c per gal. off t.w. price with some exceptions.

†These 6 points are: Hicksville, Arlington, Midway, Mortimer, Mendon, and Nevada.

*These 15 points are: Arcadia, Perrysburg, Fostoria, Urbana, Marion, St. Paris, Ada, Lima, Hamilton, Willard, Wapakoneta, Meeker, Ney, St. Johns and Piqua.

MAGNOLIA PETROLEUM

Muskogee, Okla.	12	4	16	19	13
Oklahoma City.	13	4	17	20	10
Tulsa, Okla.	11	4	15	19	10
Fort Smith, Ark.†	11	†4	15	17	12
Little Rock, Ark.	14	5	19	21	13
Texarkana, Ark.*	13	*4	17	19	12
Dallas, Tex.	13	4	17	21	13
Fort Worth, Tex.	13	4	17	20	12
Houston, Tex.	9	4	13	17	11
San Antonio, Tex.	11	4	15	19	11
El Paso, Tex.	11	4	15	18	16

*Within city of Texarkana, the state tax on gasoline is 4c per gal. conforming with the Texas state tax. In this district outside of the city the 5c Arkansas tax applies.

†Within city of Fort Smith, Oklahoma tax of 4c applies. In this district outside of the city, the 5c Arkansas tax applies.

S. O. NEW YORK

Due to local price conditions at many points in S. O. New York territory, actual prices on both gasoline and kerosene are being made at under the posted tank wagon prices published below.

Greater New York City: Boroughs of Manhattan, Bronx, Queens & Kings.	14	2	16	18	15
Borough of Richmond.	15	2	17	19	15
Albany, N. Y.	16	2	18	20	15
Buffalo, N. Y.	16	2	18	20	14
Rochester, N. Y.	16	2	18	20	13
Syracuse, N. Y.	16	2	18	20	12
Boston, Mass.	16	2	18	20	15

Above prices include these inspection fees on both gasoline and kerosene, per gallon: Alabama, 1/40c on gasoline, 1/2c kerosene; Arkansas, 1/20c on both; Florida, 1/8c on both; Georgia, 1/10c on both; Indiana, 4/25c to 1/2c on both; Kansas, 3/50c on both; Louisiana, 1/32c on gasoline; Minnesota, 3/50c on both; Missouri, 3/10c to 1/2c on both; Nebraska, 3/50c to 1/2c on both; North Carolina, 1/4c on both; North Dakota, 1/20c on both; Oklahoma, 4/25c on both; South Carolina, 1/8c on both; South Dakota, 1/10c on both; Tennessee, 2/5c on gasoline and 1/2c to 4/5c on kerosene; Wisconsin, 3/50c on both.

Kerosene inspection fees only, per gallon; Iowa, 7/100c; Michigan 1/5c to 4/5c per gal.

In Illinois, cities and villages have the power to appoint oil inspectors and fix inspection fees which is done in some instances. In some cases in the above state or other states there are local inspection fees.

Tank Wagon, Service Station Markets for Gasoline and Kerosene

Prices in Effect Oct. 28, 1929

S. O. NEW YORK

	Gasoline T.W.	Tax	Total T.W.	S.S.	Oil T.W.
Augusta, Me.	16	4	20	20	15
Manchester, N. H.	16	4	20	22	15
Burlington, Vt.	16	4	20	22	13

Note:—S. O. New York allows concessions of 1 to 2c per gal. to dealers under posted tank wagon prices.

*The Standard of New York does not operate stations in New York City. This figure is the retail price of a principal station operator in New York selling Socony gasoline.

ATLANTIC REFINING

Pittsburgh, Pa.	16	*	16	22	13
Philadelphia, Pa.	16	*	16	22	13
Allentown, Pa.	16	*	16	22	13
Erie, Pa.	13	*	13	17	13
Scranton, Pa.	16	*	16	22	13
Altoona, Pa.	16	*	16	22	13
Williamsport, Pa.	15	*	15	19	13
Dover, Del.	16	3	19	21	13
Wilmington, Del.	16	3	19	21	13
Boston, Mass.	16	2	18	20	15
Springfield, Mass.	16	2	18	20	15
Worcester, Mass.	16	2	18	20	15
Fall River, Mass.	16	2	18	20	13
Providence, R. I.	16	2	18	20	13
Hartford, Conn.	16	2	18	20	14
New Haven, Conn.	16	2	18	20	15
Atlantic City, N. J.	14	2	16	18	13
Camden, N. J.	15	2	17	19	13
Trenton, N. J.	15	2	17	19	13
Annapolis, Md.	16	4	20	22	13
Baltimore, Md.	15	4	19	21	12
Hagerstown, Md.	12	4	16	18	13
Richmond, Va.	15	5	20	22	13
Wilmington, N. C.	15	5	20	22	13
Brunswick, Ga.	16	6	22	24	**15.5
Jacksonville, Fla.	16	6	22	24	14.5

Note: 2c per gal. discount off t.w. price of gasoline thru territory; also 2c off to commercial accounts under contract for one year.

*4-cent state tax is collected by retail dealer and paid by him directly to state.

**Georgia kerosene prices include 1c state tax

V. M. & P. NAPHTHA

(Changes ordinarily occur coincident with gasoline price changes)

	Oleum Spirits	V.M.&P. Naphtha	Cleaner Naphtha
Chicago	15.7	17.2	19
Detroit	17.4	18.9	20.7
Kansas City	†15.9	†17.4	†19.2
Milwaukee	16.4	*19.9	*21.7
Minneapolis	**19.7	**21.2	*23
St. Louis	15.6	17.1	18.9
New York		16	23
Boston		19	23

*Includes 2c state tax. †Includes 1c city tax.

**Includes 3c state tax.

Petroleum Spirits

Tank Cars (Solvent)

New York refineries	11.50–12.00
Philadelphia refineries	11.50–12.00

Tank Wagon or Steel Barrels

New York City	16–18
New England	18–19
New Jersey	16–18
Pennsylvania	18–19

Note: 2c off above t.w. prices to large buyers in some instances.

CANADA

(Per Imperial Gallon, which is 1.2 American Gallons)

	Gasoline T.W.	Tax	Total T.W.	S.S.	Oil T.W.
ONTARIO					
Toronto	19.5	5	24.5	28	20.5
Ottawa	16.5	5	21.5	25	20.5
Cochrane	24.5	5	29.5	..	25.5
Ft. William	22.5	5	27.5	31	23.5
MANITOBA					
Winnipeg	21.5	3	24.5	28	21.5
SASKATCHEWAN					
Regina	26	3	29	33	26
ALBERTA					
Edmonton	27.5	5	32.5	36	27.5
Calgary	23.5	5	28.5	32	23.5
BRITISH COLUMBIA					
Vancouver	23	3	26	30	24
QUEBEC					
Montreal	20.5	5	25.5	29	21
Quebec City	21.5	5	26.5	30	22
Three Rivers	21.5	5	26.5	30	22
NEW BRUNSWICK					
St. John	22	5	27	31	24
Moncton	22	5	27	31	24
NOVA SCOTIA					
Halifax	22	5	27	31	24
Sydney	22	5	27	31	24
PRINCE EDWARD ISLAND					
Charlottetown	22	5	27	31	24

Note: In districts surrounding these points 1c additional is added to city price.

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Imperial Refineries

Imperial Refining Co. **San Angelo Refining Co.**
Kettle Creek Refining Co. **Wickett Refining Co.**

General Offices
TULSA, OKLAHOMA

Crude Oil Prices (in Effect Oct. 28, 1929)

(Crude prices for the whole year in OIL PRICE HANDBOOK published annually)

EASTERN FIELDS
(All Penna. Crude prices effective Oct. 1, 1929)

(Posted by Joseph Seep Purchasing Agency)

Penna. Grade Oil in New York Transit Lines (Alleghany, N. Y. District)	*$3.05
Bradford District Oil in National Transit Lines (Bradford District)	*3.05
Penna. Grade Oil in National Transit Lines (Other Pennsylvania)	*3.05
Penna. Grade Oil in Southwest Penna. Pipe Lines (Other Pennsylvania)	3.00
Penna. Grade Oil in Eureka Pipe Lines (West Virginia)	2.90
Penna. Grade Oil in Buckeye Pipe Lines (Macksburg, O. district)	2.70
Corning Grade in Buckeye Pipe Lines (Ohio) (Effective May 22, 1929)	1.90
Corning, O., heavy grade (Effective May 22, 1929)	1.80
Somerset Oil in Cumberland Pipe Lines (Kentucky) (Effective May 22, 1929)	1.80
Ragland Grade in Cumberland Pipe Lines (Kentucky) (Effective Jan. 29, 1929)	$0.60

***Oil run prior to July 1, 1929 is $3.00 per bbl.**

(Posted by Stoll Oil Refining Co.)

Oil City, Ky., oil in Stoll lines (Effective Oct. 7, 1929)	$1.70

MICHIGAN
(Posted by Dixie Oil Co.)

Traverse and Dundee (Muskegon):

32-32.9	$1.25	39-39.9	$1.60
33-33.9	1.30	40-40.9	1.65
34-34.9	1.35	41-41.9	1.70
35-35.9	1.40	42-42.9	1.75
36-36.9	1.45	43-43.9	1.80
37-37.9	1.50	44 and above	1.85
38-38.9	1.55		

(Posted by Pure Oil Co.)

Midland, Midland County	$1.70

CENTRAL STATES FIELDS
Posted by Ohio Oil Co.
Effective May 21, 1929

Wooster	$1.90	Princeton	$1.75
Lima	1.80	Illinois	1.75
Waterloo	1.20	Plymouth	1.28
Indiana	1.57	West Kentucky	1.83

CANADIAN CRUDE
Posted by Imperial Oil Refineries, Ltd.

Petrolia	$2.20
Oil Springs	2.27

OKLAHOMA, KANSAS and NORTH TEXAS
Prices of Paririe Oil & Gas Co.
(In Oklahoma, Kansas, North and East Central Texas)
Effective May 20, 1929

Below 25	$0.85	35-35.9	$1.40
25-25.9	0.90	36-36.9	1.45
26-26.9	0.95	37-37.9	1.50
27-27.9	1.00	38-38.9	1.55
28-28.9	1.05	39-39.9	1.60
29-29.9	1.10	40-40.9	1.65
30-30.9	1.15	41-41.9	1.70
31-31.9	1.20	42-42.9	1.75
32-32.9	1.25	43-43.9	1.80
33-33.9	1.30	44 and above	1.85
34-34.9	1.35		

Humble Oil & Refining Co. Prices

(Ranger, North Texas, Mexia, Powell, Boggy Creek, Richland, Wortham, Lytton Springs, Currie, Moran and Nocona crudes all in Texas.)

May 20, 1929, same schedule as Prairie in above fields.

Magnolia Petroleum Co.

(In Oklahoma, Kansas and North and East Central Texas)

May 20, 1929, Magnolia posted in above fields and in Panola Co., same schedule as Prairie, except these grades:

Below 26	$0.70	29-29.9	0.95
26-26.9	0.75	30-30.9	1.05
27-27.9	0.85	31-31.9	1.15
28-28.9	0.90		

May 20, 1929, Glasscock, Crane, Upton, Winkler, Howard and Mitchell Counties same prices as Humble's postings in West Texas which see.

Iatan district	$0.93
Corsicana heavy	0.80
Luling	0.90
Mirando	0.90

Carter Oil Co.
(Oklahoma and Kansas)

May 20, 1929, same schedule as Prairie except Carter does not post oil below 25.

PANHANDLE, TEXAS
Humble Oil & Refining Co.
Effective May 20, 1929

Hutchinson and Carson Counties:

Below 32	$0.90	38-38.9	$1.25
32-32.9	0.95	39-39.9	1.30
33-33.9	1.00	40-40.9	1.35
34-34.9	1.05	41-41.9	1.40
35-35.9	1.10	42-42.9	1.45
36-36.9	1.15	43-43.9	1.50
37-37.9	1.20	44 and above	1.55

Wheeler County:

Below 30	$0.90	37-37.9	$1.30
30-30.9	0.95	38-38.9	1.35
31-31.9	1.00	39-39.9	1.40
32-32.9	1.05	40-40.9	1.45
33-33.9	1.10	41-41.9	1.50
34-34.9	1.15	42-42.9	1.55
35-35.9	1.20	43-43.9	1.60
36-36.9	1.25	44 and above	1.65

Gray County:

Below 29	$0.90	37-37.9	$1.35
29-29.9	0.95	38-38.9	1.40
30-30.9	1.00	39-39.9	1.45
31-31.9	1.05	40-40.9	1.50
32-32.9	1.10	41-41.9	1.55
33-33.9	1.15	42-42.9	1.60
34-34.9	1.20	43-43.9	1.65
35-35.9	1.25	44 and above	1.70
36-36.9	1.30		

Above prices met by The Texas Co. and Magnolia on May 20.

WEST TEXAS
Humble Oil & Refining Co.
Effective May 20, 1929

Winkler, Crane, Upton, Crockett, Howard and Pecos Counties, also Lea County, N. Mex.

Below 25	$0.70	25-25.9	$0.74
26-26.9	$0.78	32-32.9	$1.02
27-27.9	0.82	33-33.9	1.06
28-28.9	0.86	34-34.9	1.10
29-29.9	0.90	35-35.9	1.14
30-30.9	0.94	36 and above	1.18
31-31.9	0.98		

May 20, 1929, The Texas Co. posted same prices as Humble in Crane, Upton, Pecos and Winkler., and Magnolia in Crane, Upton, Winkler, Glasscock, Howard and Mitchell.

SOUTHWEST TEXAS
(Posted by Humble Oil & Refining Co.)
Effective May 20, 1929

Mirando	$0.90
Salt Flat	1.25

NORTH LOUISIANA—ARKANSAS FIELDS
Prices of Standard Oil Co. of Louisiana

Caddo, Homer, Haynesville, Bull Bayou, El Dorado, Crichton, De Soto and **Cotton Valley.
Effective May 22, 1929

Below 28	$1.00	36-36.9	$1.45
28-28.9	1.05	37-37.9	1.50
29-29.9	1.10	38-38.9	1.55
30-30.9	1.15	39-39.9	1.60
31-31.9	1.20	40-40.9	1.65
32-32.9	1.25	41-41.9	1.70
33-33.9	1.30	42-42.9	1.75
34-34.9	1.35	43-43.9	1.80
35-35.9	1.40	44 and above	1.85

**Cotton Valley, below 36, $0.85. Beginning with 36-36.9, same schedule as above.

Smackover, below 24	$0.85
do 24 and above	1.00
Bellevue	1.30
*Urania, La	1.10
†East El Dorado	0.75

*Posted by Louisiana Oil Refining Corp.
†Posted by Magnolia Petroleum Co.

May 20, The Texas Co. same schedule in Louisiana as Standard, plus these grades: 24-24.9, $0.85; 25-25.9, $0.90; 26-26.9, $0.95; 27-27.9, $1.00.

May 22, Magnolia, Atlantic, Shreveport-Eldorado Pipe Line, Louisiana Oil, and Gulf Companies met Standard schedule in Louisiana-Arkansas fields.

STEPHENS, ARKANSAS
Louisiana Oil Refining Corp., and Atlantic Oil Producing Co.
Effective May 22, 1929

Below 28	$0.90	30-30.9	$1.02
28-28.9	0.94	31-31.9	1.06
29-29.9	0.98	32 and above	1.10

GULF COASTAL
Posted by Humble Oil & Refining Co.
Effective May 20, 1929

Grades A	$1.30	29-29.9	$1.30
Grades B:		30-30.9	1.33
Below 25	$1.15	31-31.9	1.36
25-25.9	1.18	32-32.9	1.39
26-26.9	1.21	33-33.9	1.42
27-27.9	1.24	34-34.9	1.45
28-28.9	1.27	35 and above	1.48

Fields classified as A and B are Spindletop, Goose Creek, Hull, Liberty, Sour Lake, West Columbia, Orange, Boling, Pierce Junction, Sugarland and Raccoon Bend. All other fields are Grades A only

Court Rules on Liability For Negligence

CLEVELAND, Oct. 26.—That an oil company is responsible for property damage to a customer's automobile resulting from negligence in free service at its stations has been determined in a jury case, and the verdict has been sustained in a state court of appeal.

The case was that an attendant replaced the plug after a crankcase drain, but did not tighten the plug with a wrench. After 50 or 60 miles driving the customer claimed his oil drained out, resulting in burned out bearings. The customer recovered $205 damage from the oil company.

"It is perfectly manifest in this case that the plug was put in," said the court of appeals in affirming the lower court, "but according to the testimony of the experts, if it had been properly put in and a wrench had been properly used, it could under no circumstances have come out. So then, the inference from this fact—not an inference from an inference—would be that the plug was not perfectly screwed in; that is, no wrench had been properly used on it."

In contesting the case the oil company contended that the driver could have known the level of the oil in the crankcase by watching the oil gauge on the dash board, so that if the oil did drain out the driver could have investigated before damage was done to the motor.

That the oil had been changed at this oil company's station was admitted. The driver had a duplicate of the check for the work done.

The customer based his case on the point that the attendant had been negligent in not replacing properly the crankcase plug.

Smaller Gain In Crude Stocks

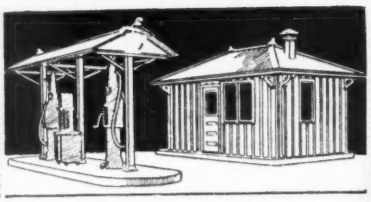
NEW YORK, Oct. 24.—Pipe line and tank farm gross domestic crude stocks east of the Rocky Mountains increased 619,000 barrels during September, according to the American Petroleum Institute. This compares with an increase of 3,240,000 barrels during August.

Crude Price Changes

LOS ANGELES—On Oct. 21 Union Oil Co. of California met the Standard's new postings in the Santa Fe Springs, Signal Hill and Seal Beach fields, and extended these changes into the Ventura field.

The cut in Ventura prices ranges from 30 to 54 cents on heavy grades to 38 to 74 cents on lighter grades. Grades from 14 to 24.9 inclusive are 40 cents, and from 25 to 35.9 inclusive, 60 cents per barrel.

Steel
Filling Stations



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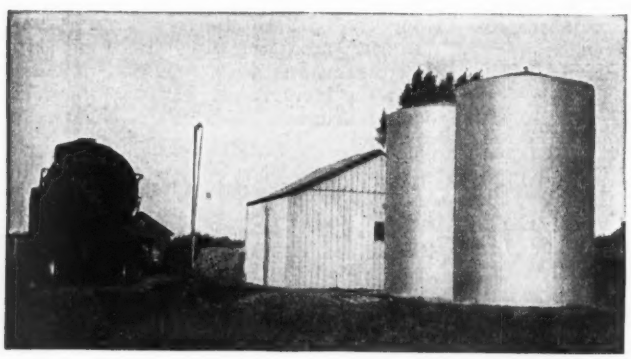

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Crude Oil Prices (in Effect Oct. 28, 1929)

(Crude prices for the whole year in OIL PRICE HANDBOOK published annually)

GULF COASTAL

Prices of The Texas Co.

Effective May 20, 1929

Grades A	$1.30	*Grades B	$1.15
‡Grades B (light crude):			
35-35.9	$1.49	40-40.9	$1.69
36-36.9	1.53	41-41.9	1.73
37-37.9	1.57	42-42.9	1.77
38-38.9	1.61	43-43.9	1.81
39-39.9	1.65	44 and above	1.85

*Grades B include all heavy crudes which do not meet tests for Grades A or for Gulf Coast light crude.

‡The Texas Co.'s gravity and price schedule on all below 35° is same as Humble's postings on Grades B

ROCKY MOUNTAIN FIELDS

Prices of Ohio Oil Co., and Midwest Refining Co.

(Salt Creek prices effective May 20, 1929)

‡Salt Creek 29-29.9	$1.10
" " 30-30.9	1.15
" " 31-31.9	1.20
" " 32-32.9	1.25
" " 33-33.9	1.30
" " 34-34.9	1.35
" " 35-35.9	1.40
" " 36-36.9	1.45
" " 37 and above	1.50
Elk Basin	1.65
Grass Creek light	1.65
Big Muddy	$1.43
Lance Creek	1.68
Rock Creek	1.40
Mule Creek	1.20
Rex Lake	1.10
‡Osage	1.65
‡Cat Creek, Mont.	1.65
Sunburst, Mont.	1.75
‡Hogback, N. Mex.	1.70
Artesia, N. Mex.	1.08

‡Posted by Midwest Refining Co. Midwest also buys Grass Creek light and Elk Basin.

CALIFORNIA

***Standard Oil Co. of California**

Gravity	Signal Hill Seal Beach	Alamitos Heights Huntington Beach	Inglewood Torrance	Olinda-Brea Canon †Richfield	Athens-Rosecrans Dominguez	Elwood Terrace	Whittier La Habra	Coyote Hills	Santa Fe Springs	Newhall McKittrick Kern River	Midway, Sunset Buena Vista & Elk Hills	Lost Hills	Coalinga	Wheeler Ridge	Montebello	Kettleman Hills	*Santa Maria (Orcutt)	*Ventura
14-14.9	....	$ .70	$ .70	$ .70	....	....	$ .70	$ .70	....	$ .50	$ .50	$ .50	$ .50	$ .50	$ .70	....	$ .65	$ .40
15-15.9	....	.70	.70	.70	....	....	.70	.70	....	.50	.50	.50	.50	.50	.70	....	.65	.40
16-16.9	....	.70	.70	.70	....	....	.70	.70	....	.50	.50	.50	.50	.50	.70	....	.65	.40
17-17.9	....	.70	.70	.70	....	....	.70	.70	....	.50	.50	.50	.50	.50	.70	....	.65	.40
18-18.9	....	.75	.75	.75	....	....	.75	.75	....	.50	.56	.56	.56	.56	.70	....	.70	.40
19-19.9	$.40	.80	.80	.80	....	....	.80	.80	....	.50	.62	.62	.62	.62	.75	$1.65	.70	.40
20-20.9	.40	.85	.85	.85	....	....	.84	.84	....	....	.68	.68	.68	.68	.80	for	.70	.40
21-21.9	.40	.89	.89	.89	....	....	.88	.88	.40	....	.74	.74	.74	.74	.85	55°	.86	.40
22-22.9	.40	.93	.93	.93	....	....	.91	.91	.40	....	.80	.80	.80	.80	.90	gravity	.87	.40
23-23.9	.40	.97	.97	.97	....	....	....	.94	.40	....	.85	.85	.85	.85	.95	and	.90	.40
24-24.9	.40	1.01	1.01	1.01	1.01	....	....	.97	.40	....	.90	.90	.88	.88	.98	over	.94	.40
25-25.9	.60	1.05	1.05	1.05	1.05	....	....	1.00	.40	....	.95	.95	.91	.91	1.01	....	.98	.60
26-26.9	.60	1.09	1.09	1.09	1.09	....	....	1.04	.40	....	1.00	1.00	.94	.94	1.04	....	1.02	.60
27-27.9	.60	1.13	1.13	1.13	1.13	....	....	1.08	.40	....	1.05	1.05	.98	.97	1.07	....	....	.60
28-28.9	.60	1.17	1.17	1.17	1.17	....	....	1.12	.40	....	1.10	1.10	1.02	....	1.10	....	....	.60
29-29.9	.60	1.21	....	1.21	1.21	....	....	1.16	.60	....	1.16	1.16	1.06	....	1.13	....	....	.60
30-30.9	.60	1.25	....	1.25	1.25	....	....	1.20	.60	....	1.22	1.22	1.10	....	1.16	....	....	.60
31-31.9	.60	1.30	....	1.30	1.30	....	....	....	.60	....	1.28	1.28	1.14	....	....	....	....	.60
32-32.9	.60	1.35	....	....	1.35	....	....	....	.60	....	1.34	1.34	1.18	....	....	....	....	.60
33-33.9	....	....	....	....	1.41	....	....	....	.60	....	1.40	1.40	1.22	....	....	....	....	.60
34-34.9	....	....	....	....	1.47	$1.16	....	....	.60	....	....	1.46	1.26	....	....	....	....	.60
35-35.9	....	....	....	....	1.53	1.22	....	....	.60	....	....	1.52	1.30	....	....	....	....	.60
36-36.9	....	....	....	....	1.59	1.28	....	....	.60	....	....	....	....	....	....	....	....	....
37-37.9	....	....	....	....	1.65	1.34	....	....	.60	....	....	....	....	....	....	....	....	....
38-38.9	....	....	....	....	1.71	1.40	....	....	.60	....	....	....	....	....	....	....	....	....
39-39.9	....	....	....	....	1.77	1.46	....	....	.60	....	....	....	....	....	....	....	....	....
40-40.9	....	....	....	....	1.83	1.52	....	....	....	....	....	....	....	....	....	....	....	....
41-41.9	....	....	....	....	1.89	1.58	....	....	....	....	....	....	....	....	....	....	....	....
42-42.9	....	....	....	....	1.95	1.64	....	....	....	....	....	....	....	....	....	....	....	....

*Santa Maria and Ventura postings are by Union Oil Co. Union Oil Co. posts same prices in all above fields as Standard except it does not post prices in Wheeler Ridge, Whittier, La Habra, Newhall and Kettleman Hills. Standard does not contract for crude testing 11-13.9 gravity, but pays 45c a barrel when purchased.

†Richfied posted only to 30–30.9 at $1.25.

REFINERS' and COMPOUNDERS' SUPPLIES

Following are average market prices for materials used by refiners and compounders effective on the date shown.

Refiners' Supplies

	Oct. 28	Oct. 21
Soda Ash light 58% bags, cwt.	$1.32	$1.32
Silicate of Soda 60 deg. drums, ...cwt.	$1.55	$1.55
Silicate of Soda 40 deg. tank cars....cwt.	$0.60	$0.60
Silicate of Soda 40 deg. drums ....cwt.	$0.80	$0.80
Sal Soda wks....	$0.90-1.00	$0.90-1.00
Caustic Soda 76% solid, cwt.	$2.90	$2.90
Sulfuric Acid 60 deg. tank cars, f.o.b. shipping point per ton....	$11.00	$11.00
Oleum 20%, fuming sulfuric, tank cars, wks....	$18.50	$18.50
Sulfur, flowers of....cwt.	$3.10-4.00	$3.50-4.50
Liquid Chlorine, tank cars, wks....lb.	3.50-5.00	3.50-5.00

Compounders' Supplies

	Oct. 28	Oct. 21
Vegetable Oils		
Linseed carloads, spot....lb.	15.50	15.90
Tanks, spot....	14.70	15.10
Soya Bean, Tanks, coast, lb.	10.50–11.00	11.25
Oleic Acid		
Distilled, tanks....lb.	9.75	9.75
Distilled, bbls....lb.	10.625	10.625
Saponified, tanks....lb.	9.75	9.75
Saponified, bbls....lb.	10.625	10.625
Lard Oils		
Prime Winter Strained....lb.	15.25	15.25
Extra Winter Strained....lb.	12.75	12.75
Extra....lb.	12.50	12.50
Extra No. 1....lb.	12.00	12.00
No. 1....lb.	11.75	11.75
No. 2....lb.	11.50	11.50
Tallow oil....lb.	11.00	11.00
Neatsfoot Oil		
Pure, bbls....lb.	14.50	14.50
Extra, bbls....lb.	12.25	12.25
No. 1 bbls....lb.	12.00	12.00
Cold Pressed....lb.	12.50	12.50
Fish Oils		
Menhaden Oil		
Light Pressed....gal.	70	70
Light Pressed, tank cars, N. Y....gal.	58–60	58–60
White bleached....gal.	76	76
Yellow bleached....gal.	71	71
Whale, extra winter bleached, ...gal.	82	82
Naval Stores		
Steam distilled turpentine, N. Y....gal.	53	53
Steam distilled turpentine, Savannah....gal.	53	53
Gum turpentine, N. Y....gal.	56.50	56.50
Gum turpentine, f.o.b. cars Savannah....gal.	50.50	50.50
Wood Rosin F, N. Y....bbl.	$8.05	$8.05
Wood Rosin F, Savn'h..bbl.	$7.25	$7.25
Gum Rosin B, N. Y....Bbl.	$9.00	$9.00
Gum Rosin B, f.o.b. cars Savannah....bbl.	$8.15	$8.15
Rosin oil, pure....gal.	61	61
Rosin oil, compounded...gal.	51	51
Pine Tar		
Kiln burnt....bbl.	$13.00-14.00	$13.00-14.00
Retort....bbl.	$13.50-14.50	$13.50-14.50
Alcohol		
Denatured Formula 5, in bbls., per gal....	59–66	59–66

Heavy Export Gasoline Purchases Aid Mid-Continent Refiners

By Allen S. James
N. P. N. STAFF WRITER

TULSA, Oct. 26

THE heaviest buying of Mid-Continent gasolines for export shipment for the past several months was developed October 23 and 25 when at least five export companies purchased approximately 18 million gallons. Delivery was to be over the remainder of this year, with shipment to Gulf terminals of the purchasing companies. Purchases were made in virtually all districts where these two grades are manufactured.

The bulk of the gasoline bought was 64-66, 375 end point, at a price of 7.75 cents a gallon. Some 61-63, 390 e.p. gasoline also was purchased at a price of 7.50 cents a gallon.

The posted price at the Gulf on Oct. 26 for 64-66, 375 e.p. gasoline was 10 cents a gallon, and 9.75 cents a gallon for 61-63, 390 e.p. grade. The freight rate from north Texas to the Gulf is 1.35 cents a gallon, which would leave the exporters nine-tenths of a cent a gallon to cover evaporation losses, handling, insurance and interest on investment, and profit.

The general market situation the next few weeks will be closely watched by the trade generally, to see what effect the buying will have on gasolines for domestic use. Mid-Continent refiners generally who had been in favor of the Petroleum Export Association formed some months ago, were known to have felt the past few months that they had not obtained their share of the export business this year.

This development was generally understood to have resulted in the buying by the exporters, all of whom are members of the association. Rumors that the buying was pending were heard more than a week before any purchases were made, and at that time it was understood between 12 and 20 million gallons would be bought.

The purchases might have been made a few days earlier had it not been for the sudden move in California which resulted in the drastic cut in crude oil prices. It was feared for a short time the cut in crude in that state would check the contemplated buying in the Mid-Continent. California in times past has been a detrimental factor in the Mid-Continent export business and with crude at 40 to 60 cents a barrel it was feared in some quarters crude runs would be boosted to even higher levels in that district and naturally it would mean more gasoline for export or coastwise movement at a manufacturing cost cut almost in half.

Virtually all refiners, especially those in north Texas, who desired to accept a part of the export business were given that opportunity. It is too early as yet to state with any degree of definiteness what effect the purchases will have, but it is generally understood that on the present basis of crude charges to stills, refiners who accepted any of the business will not have to depend to as great an extent on the domestic market for the remainder of the year.

Should the refiners who sold for export boost their crude runs in order to get out the gasoline, and still try to play with the domestic market, the export buying probably will do little to remedy the situation with reference to stocks in the Mid-Continent. Only in a few quarters, however, is the opinion expressed that crude runs will be increased, although it was reported late in the week that at least one refinery in north Texas which had been shut down and had been storing crude, would resume operations in order to run up the stored crude. The gasoline produced, however, will be shipped on the export order which in the final analysis means just that much crude will not be used to make domestic gasolines.

IT IS difficult to estimate what proportion of the export gasoline bought will be filled from refiners' storage and what will be manufactured during the remainder of the year. It is known, however, that several refiners throughout the summer had anticipated some buying by the Export Association and had continued to make and store the higher gravity gasoline. Some of the orders undoubtedly will be filled from this source.

The trade at present is wondering what effect the export buying will have on the practice which has prevailed for the past several months of foreign buyers coming direct to the Mid-Continent and buying their gasolines f.o.b. refinery and paying the freight and handling charges, and loading at a terminal which had been leased at the Gulf.

A Tulsa marketer the past few months has handled several cargoes for foreign buyers. This marketer merely acted in the capacity of purchaser. A letter of credit was deposited in a Tulsa bank, and after the broker closed a deal with a refiner, that refiner drew against that letter of credit as he shipped the goods to the Gulf terminal.

WITH the Petroleum Export Association almost inactive as far as this district was concerned, this type of buying constituted the bulk of the export business. As to whether or not the foreign buyers actually made any money on the direct-from-refiner purchase plan is not known here.

If the buying the past week was sufficiently heavy to give the refiners all the business they need on the present crude runs levels, there may be some difficulty on the part of the foreign buyers in assembling any more cargoes before the first of the year, since the buying was so widely spread.

It was reported late in the week that the buyers for the foreign interests had inquired for some 64-66, 375 e.p. gasoline in north Texas, offering 7.90 cents for the goods, but the report could not be confirmed at his offices in Tulsa. Neither could any purchases at that figure, which was 0.15 cent a gallon higher than the other prices paid, be confirmed before close of business Oct. 26.

When north Texas refiners make high gravity gasolines for export there generally is a naphtha or a 450 e.p. gasoline cut left over which is blended and sold as a 58-60, 437 e.p. or a 58-60, 450 e.p. product.

There probably will be less U. S. Motor offered by north Texas refiners for shipment in competition to other districts, but there probably will be a quantity of the blended goods placed on the market, unless the demand in the state is sufficient to take up this product. The blending naturally will increase the demand for natural gasolines to a certain extent.

OIL STOCKS AND FINANCES

National Petroleum News

Phillips Reports Tenfold Gain In Own Sales at Retail

CLEVELAND, Oct. 26

SALES of gasoline and refined oils by the Phillips Petroleum Co. are running 10 times as large this year as last, O. K. Wing, treasurer of the company, reports in a statement to stockholders issued in connection with the company's earnings statement for the third quarter of 1929.

Sales of Philfuels, the liquefied gas for household purposes, are more than 11 times as large this year as last. The company's sales of dry gas were approximately 60 per cent larger this year than last year.

Mr. Wing's statement of the Phillips activities follows:

"Earnings for the third quarter after all charges except depletion and depreciation were $6,518,780.78 compared with $5,846,156.29 for the corresponding period in 1928. For the first nine months of this year earnings amounted to $15,029,588.29 compared with $12,366,133.66 for the same period last year. Each quarter of the current year has reflected larger earnings than that preceding due largely to the steadily growing business of those divisions of the company not affected by overproduction of crude oil.

"Expansion in the retail marketing division is being vigorously pursued. Including purchase just made, nearly 150 stations have been purchased from smaller operators in our territory since our last report and at this time our company is operating nearly 600 retail and wholesale stations not including the resale accounts. Sales are now running at an annual rate of approximately 100,000,000 gallons compared with an annual rate of less than 10,000,000 gallons a year ago.

"The enlargement of our refinery is progressing rapidly and it should be running to capacity around the first of the year.

"Production of natural gasoline is fast approaching 800,000 gallons a day, an increasing portion of which is being marketed in the company's controlled volatility gasoline, 'Phillips 66' and 'Phillips 66 Ethyl.' The balance is sold at wholesale in tank car lots.

"Crude oil production also showed an increase in the third quarter due to bringing in some large wells. We are, however, keeping our drilling program at a minimum and are shutting in production wherever possible.

"The sale of Philfuels has shown a remarkable increase this year and especially in the third quarter. Retail domestic fuel sales for this quarter were approximately 1,150,000 pounds compared with 100,000 pounds for the same quarter of 1928. The wholesale and industrial fuel divisions have shown gains proportionately as large.

"Sales of dry gas for the nine months have been over 123,000,000,000 cubic feet, compared with 83,000,000,000 cubic feet for the same period of last year. Our interest in carbon black is also increasing. Production for the nine months of this year amounted to almost 12,250,000 pounds as compared with 2,900,000 pounds for the corresponding period of 1928, and present production is at an annual rate of approximately 40,000,000 pounds.

"Considering the large capital expenditures which it has been necessary to make during the year in all these various divisions, we still maintain a strong current position, with cash and other current assets of nearly $25,000,000 and current liabilities of $5,700,000.

"Consumption of petroleum products has shown a remarkable increase in 1929. Demand for gasoline for the first eight months of this year increased 15 per cent over the same period of 1928. The outlook for the petroleum industry is considerably improved due to recent agreements among the producers in the Mid-Continent area to prorate production to current requirements. Similar action has been taken before but never with unanimous accord and such complete and whole-hearted cooperation. This is undoubtedly one of the foremost steps ever taken to stabilize the petroleum industry and to conserve its resources. The new gas conservation law in California will probably be in force during the next thirty or sixty days. This, together with the cooperative movement in the Mid-Continent area is expected to hold the production of crude oil in the United States to requirements. With supply and demand thus balanced during the winter months, it appears that the industry will enter the period of high consumption next year in a better condition than at any time during recent years of overproduction."

Cargo Gasoline Sales and Light Crude Output Aid Union Oil

CLEVELAND, Oct. 26

CARGO sales of gasoline and the larger production of refinable crude in the Santa Fe Springs area, are given by the Union Oil Co. of California as the reasons for the increase in net earnings in the first nine months of this year over the first nine months of 1928.

The increase in crude oil and natural gasoline production by the company in California the first nine months amounted to 6,950,000 barrels over production in the corresponding time last year. Concerning the company's operations and financial standing President W. L. Stewart wrote stockholders recently as follows:

"The larger profit for 1929 is accounted for principally by increased production of refining crude at Santa Fe Springs and expansion of the gasoline cargo business at better prices. The charges to income for labor and incidental costs of new drilling were about $2,500,000 more than for the same period of 1928, due to increased drilling in the Santa Fe Springs area.

"Production, subject to royalties, of crude oil and natural gasoline for the nine months approximated 17,300,000 barrels, an increase of 6,950,000 barrels over the same period last year. During the nine months 30 wells were completed at Santa Fe Springs while 21 were drilling at Sept. 30. At present the company is producing and purchasing 130,000 barrels of crude

(*Continued on Page* 367)

Transactions in Oil Shares on New York Stock Exchange

1928 High	1928 Low	1929 High	1929 Low	Listed Capital	Par Value	Stocks	Div. Rate	Last Paid	Transactions Week Ended Oct. 26 Sales	First	High	Low	Last	Change
43⅞	27⅛	42⅝	22½	(sh) 922,075	N.P.	Amerada Corp.	50cQ	Oct. 31, 29	26,000	26	27	22½	24½	— 2⅜
85	51¼	64¾	20½	(sh) 209,180	N.P.	American Republics Corp.	....	.....	74,000	34	36⅞	†20½	28	— 9
53¾	37½	47¼	40½	$56,000,000	$25	Associated Oil	50cQ	Sept. 30, 29	.....	....	....	....	....	....
62½	50	77⅜	40	50,000,000	25	Atlantic Refining	‡25cQ	Sept. 15, 29	294,000	55⅛	56⅜	†40	49¾	— 5⅛
53	20	49⅛	20⅞	47,261,125	25	Barnsdall Corp. A	‡50cQ	Aug. 6, 29	190,500	32	32	†20⅞	27⅝	— 4⅜
51⅜	20	49	38⅛	300,525	25	do B	‡50cQ	Aug. 6, 29	.....	....	....	....	....	....
24½	12¼	32⅞	20	(sh) 956,075	N.P.	Beacon Oil	....	.....	24,500	27	27½	22¼	23½	— 4
36	25¼	34½	25	$51,524,150	$25	California Petroleum	....	Jan. 1, 29	30	30	30	30	30	— 1
....	....	37¾	25½	(sh) 4,634,163	N.P.	Continental Oil (Delaware)	....	.....	870,600	36¾	37	†25½	32½	— 4⅛
94⅞	68	94¾	59¾	21,031,400	100	General Asphalt	....	.....	27,800	80¼	81½	†59¾	64⅞	— 9⅛
141	110⅜	138	104½	6,628,200	100	do pfd	$1.25Q	Sept. 3, 29	500	118	119	110	111	—14
167	79	109	50	25,000,000	100	Houston Oil	....	.....	41,100	85	86	†50	66½	—18⅜
38⅜	21¾	39¼	25⅜	(sh) 1,333,157	N.P.	Independent Oil & Gas	50cQ	Oct. 31, 29	45,100	29⅝	30	†25⅛	27½	— 2⅜
39⅝	9	53	23½	$4,299,190	$10	Indian Refining	....	Dec. 15, 20	100,000	38¾	39¾	†23½	27	—12
37¼	8½	51¼	20½	4,550,110	10	do ctfs	....	.....	58,300	37⅛	37½	†20½	25	—12
185	140	165	160	1,977,700	100	do pfd. new	$1.75Q	Oct. 1, 29	.....	....	....	....	....	....
39⅛	27⅝	38⅝	26	3,992,387	N.P.	Lago Oil & Transport	....	May 2, 27	3,600	29⅝	30	25	29½	— ⅝
19¾	9⅜	18	10	(sh) 1,187,298	N.P.	Louisiana Oil Refining	....	.....	41,800	10¾	11¼	†10	10½	— ½
96	78	100¼	89	$4,000,000	$100	do pfd	$1.62½	Aug. 15, 29	40	90⅜	90⅜	90⅜	90⅜	0
25½	12½	18½	11⅝	(sh) 330,000	N.P.	Maracaibo Oil	....	.....	5,500	14	14¼	11⅝	12	— 2
360	250	295	202	$45,942,800	$100	Mexican Petroleum	$3Q	Oct. 20, 29	.....	....	....	....	....	....
....	....	....	....	12,000,000	100	do pfd	$2Q	Oct. 20, 29	.....	....	....	....	....	....
73	4⅝	69⅛	9¼	(sh) 995,500	N.P.	Mexican Seaboard	....	Nov. 15, 24	124,700	23	25¼	†9¼	20	— 3
44½	25⅛	39⅞	29¾	(sh) 1,857,461	N.P.	Mid-Continent	50cQ	Aug. 15, 29	44,400	32¾	33	†29¾	30⅛	— 2⅞
120½	103¼	121	120¼	$6,718,000	$100	do pfd	$1.75Q	Sept. 1, 29	.....	....	....	....	....	....
7⅜	2⅜	5⅛	1	23,849,720	10	Middle States	....	July 1, 23	10,600	1⅞	2	†1	1⅞	— ⅛
5⅞	1½	3⅜	1	5,950,500	10	do ctfs	....	.....	10,900	1½	1⅝	†1	1½	0
2¼	1	1½	⅞	(sh) 3,500,000	N.P.	Pacific Oil	....	.....	33,700	1	1	†⅞	1	0
55½	38¼	69	40¼	$50,000,000	$50	Pan American P. & T.	....	Oct. 20, 27	14,200	63	66	58½	64¾	+ ¾
58⅞	37⅝	69¼	40½	121,101,400	50	do B	....	Oct. 20, 27	167,500	63⅝	64½	56	64⅜	+ ⅝
28⅝	15½	17½	13½	(sh) 400,000	N.P.	Pan American Western B	....	Jan. 30, 27	.....	....	....	....	....	....
21⅜	11½	15¼	5	(sh) 199,370	N.P.	Panhandle P. & R	....	.....	4,500	7⅛	7⅛	†5	5½	— 1⅞
106¼	70	76	47½	$2,935,200	$100	do pfd	....	July 2, 23	1,100	49½	55	49½	55	+ 2
53⅞	35¼	47	27⅝	(sh) 2,406,803	N.P.	Phillips Petroleum	37½cQ	Oct. 1, 29	104,900	39¾	41	†27⅝	37⅛	— 2⅜
5¼	½	3⅜	1½	$29,622,925	$25	Pierce Oil Corp.	....	.....	8,300	1¾	1¾	1½	1½	— ¼
50	16¼	51½	30	15,000,000	100	do pfd	....	Feb. 1, 22	1,100	39	39	35	35	— 5
6⅝	3½	5⅞	3⅛	(sh) 2,500,000	N.P.	Pierce Petroleum	....	.....	11,800	3⅞	3⅞	†3⅛	3½	— ⅜
64⅝	59½	65⅝	49⅜	$60,636,450	$25	Prairie Oil & Gas	‡50cQ	Sept. 30, 29	24,100	54	54	†49⅜	50⅛	— 3⅞
....	....	65	53⅝	101,250,000	25	Prairie Pipe Line	‡75cQ	Sept. 30, 29	19,300	61½	62⅞	57⅞	58½	— 3
29⅞	16	25⅞	4	37,450,850	50	Producers & Refiners	....	Sept. 15, 23	3,500	12	12½	†4	9½	— 2¾
49⅝	41	46⅝	27	2,845,350	50	do pfd	....	May 1, 25	110	...	34½	34	34	— 1
31¼	19	30¾	23¼	75,959,255	25	Pure Oil Co.	37½cQ	Sept. 1, 29	101,900	28⅛	28⅝	24¾	26½	— 1⅝
119	108	116	110½	13,000,000	100	do 8% pfd	$2Q	Oct. 1, 29	260	...	114	111⅛	112½	— 1½
56	23½	49⅝	20	47,127,725	25	Richfield Oil	50cQ	Aug. 15, 29	86,600	37	37	†20	32½	— 5
....	....	42½	15	(sh) 1,200,000	N.P.	Rio Grande Oil Co.	‡$1S.A.	July 25, 29	48,900	22⅛	25	†15	23½	— 2⅞
64	44⅝	64	48	(sh) 546,646	$13.40	Royal Dutch N. Y. shares	$1.873	Aug. 10, 29	188,400	60⅜	61	†48	55¼	— 4⅝
57½	39⅛	55¾	43	(sh) 65,203,000	£2	Shell Transport & T	$1.447	July 23, 29	.....	....	....	....	....	....
39⅜	23¼	31⅜	24	12,254,979	N.P.	Shell Union Oil	35cQ	Sept. 30, 29	78,300	26⅜	26⅜	†24	25⅜	— 1⅛
27¼	18¼	40¾	18¼	$8,357,280	$10	Simms Petroleum	40cQ	Sept. 14, 29	193,700	30½	30¾	24½	25	— 5⅛
46¾	17⅜	45	31½	5,494,095	N.P.	Sinclair Consolidated	‡50cQ	Oct. 15, 29	371,900	33¼	33¾	25	31	— 2⅛
110	102½	111	107¾	$16,025,200	$100	do pfd	$2Q	Aug. 15, 29	700	109½	110	109½	109½	+ ¼
42⅝	25	46½	31	27,396,590	25	Skelly Oil Co.	50cQ	Sept. 16, 29	41,900	37⅞	38¾	†31	35	— 3½
80	53	81⅞	64	(sh) 13,016,435	N.P.	S. O. California	62½cQ	Sept. 16, 29	119,800	72½	72⅝	65	69¾	— 2⅞
59¾	37¾	83	48	$612,095,850	$25	S. O. New Jersey	‡25cQ	Sept. 16, 29	819,400	77	79½	61⅝	72¾	— 4¼
45½	28¾	48⅛	34⅝	434,094,575	25	S. O. New York	40cQ	Sept. 16, 29	209,800	42½	43	†34⅜	40	— 2½
77	31½	84¾	57	(sh) 1,297,847	N.P.	Sun Oil	25cQ	Sept. 16, 29	5,400	81	81	72	73½	— 8⅜
110	100	105½	100	$5,000,000	$100	do pfd	$1.50Q	Sept. 1, 29	200	...	105	104½	104½	+ ½
14¼	2½	24	9½	(sh) 1,304,698	N.P.	Superior Oil Corp.	....	Dec. 20, 20	38,800	17	17¾	†9½	14¼	— 3¾
74⅝	50	71⅞	57¾	$211,082,925	$25	The Texas Corp.	75cQ	Oct. 1, 29	449,400	62⅛	63	57¼	58¾	— 3½
26⅜	12⅛	23⅞	11⅜	8,380,340	10	Texas Pacific Coal & Oil	2½%s	Sept. 30, 29	26,400	15¼	15⅜	†11⅜	14⅛	— 1
41½	19⅝	40	25⅛	(sh) 2,179,275	N.P.	Tide Water Oil Co.	20cQ	Sept. 30, 29	1,500	32⅛	32½	29¾	29¾	— 1
100⅛	86¾	97½	89¾	$20,321,000	$100	do 5½% pfd	$1.25Q	Aug. 15, 29	900	92¾	82¾	90¾	91¼	— ½
25	14¾	23½	14	(sh) 4,877,976	N.P.	Tide Water Associated	....	Aug. 1, 27	118,600	17½	18	†14	15⅝	— 1⅜
91¾	81⅞	90⅞	83	$72,989,200	$100	do pfd	$1.50Q	Oct. 1, 29	1,300	85¼	85¼	†83	84	— 2
14½	6¾	15¼	6¼	(sh) 3,842,029	N.P.	Transcontinental Oil	....	.....	377,600	12	12	†6¼	9½	— 2⅜
58	42¾	54½	43½	$40,858,375	$25	Union Oil of California	50cQ	Aug. 10, 29	35,500	50⅛	51½	†43⅛	49½	— 1⅜
128⅛	110	163¾	121⅞	31,101,200	100	Union Tank Car Co.	$1.25Q	Sept. 3, 29	3,900	150	150	140	140	—10
44⅞	26	42⅞	15	(sh) 488,359	N.P.	Warner Quinlan	50cQ	Oct. 1, 29	40,200	27¾	28½	†15	23⅜	— 4⅞
38	20⅜	38	29¾	(sh) 490,000	N.P.	White Eagle Oil & Refining	50cQ	Oct. 21, 29	8,400	34	34	†29¾	31¾	— 1
22⅛	17¾	29¾	16	(sh) 428,967	N.P.	Wilcox Oil & Gas	....	May 10, 28	2,900	21	21	18¾	19	— 1½

•New High †New Low XEx-Dividends ‡Also Extras s-Stock Total Sales 5,760,640

Pittsburgh Stock Exchange

Transactions Week Ended Oct. 26, 1929

	Sales	High	Low	Last	Change
Ark. Nat. Gas	6,780	20	14	16	—4
do pfd	9,956	8⅜	8⅛	8⅛	— ¾
Devonian Oil	1,290	14½	12	13	—2
Dixie Gas & Util. pfd	535	80	75⅛	80	+4⅞
Lone Star Gas	34,806	55½	36	47⅞	—7⅝
Phoenix Oil pfd	500	.50	.50	.50	....
Plymouth Oil	3,237	31	25	26	—6
Shamrock O & G.	6,915	19	14	18⅜	+4⅛
Wiser Oil	25	14¾	14¾	14¾	+1

Pittsburgh Curb Market

Transactions Week Ended Oct. 26, 1929

	Sales	High	Low	Last	Change
Ark. Gas "A"	2,949	19½	16	16	—3⅜

EL DORADO, Kan., Oct. 26.—The El Dorado Refining Co. has installed a private telegraph branch in its general offices here. The company has enlarged its office quarters and now occupies the entire third floor of the El Dorado National Bank building.

Middle States Plan Operative

NEW YORK, Oct. 25.—The reorganization committee of the Middle States Oil Corp. has announced that sufficient stock and securities have been deposited to make operative the reorganization plan announced last July. That all stock and securities holders may participate in the plan, the time limit for depositing stock or securities has been extended to Nov. 4.

NEW YORK—Two 8400 deadweight tons of steel tankers have been ordered by the Sinclair Refining Co. from the Bethlehem Shipbuilding Corp. These boats will be named the Harry F. Sinclair, Jr. and the Virginia Sinclair, after the two children of H. F. Sinclair, chairman of the board of directors of the Sinclair Consolidated Oil Corp.

The new tankers will carry refined products from Gulf ports to the company's refineries and terminals at the Gulf and Atlantic seaboard.

Cleveland Stock Market

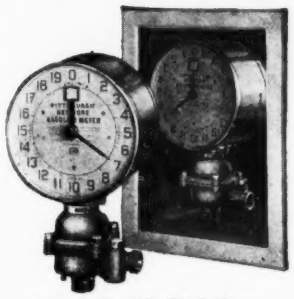
Oct. 25	Par Value	Bid	Asked
Canfield Oil Co.	$100	...	146
do pfd	100	...	104½
Fred G. Clark	10	10	11
National Refining	25	37	40
do pfd	100	131	135
Paragon Refining	25	12	15
do pfd	N.P.	41½	50
do ctfs	..	..	17

x Ex dividend.

BOSTON—Purchase of the Westcott Valve Co., East St. Louis, Ill., was made by the Walworth Co. of Boston, manufacturer of valves, fittings and tools, on Oct. 1. The Westcott company will continue the manufacture of valves as a separate entity, according to Prentiss L. Coonley, vice president of the Walworth company.

Oil field equipment is made entirely by the Westcott company, consisting of steel drilling gate valves particularly, as well as steel, iron body and semi-steel gate valves adapted to oil field use.

PITTSBURGH GASOLINE & OIL METERS



10 inch Double Dial Meter

The most effective method of dispensing gasoline is by means of the meter system, with a Pittsburgh Gasoline Service Station Meter as the measuring and recording unit. The meter system is superior to other systems because of the rapidity and accuracy with which gasoline may be dispensed. With the proper equipment it is simply necessary for the operator to place the nozzle end of the hose in the opening of the customer's gasoline container and control the flow of gasoline by means of the lever on the nozzle, watching the flow of gasoline as indicated by the Meter dial until the desired quantity has been dispensed. With this ease of service the customer usually says "Fill it up," instead of buying a pre-determined amount of gas.

The register is equipped with two hands operating on the same center. The large black hand points to the extreme outside circle and each revolution of that hand indicates one, five or ten gallons, depending upon the size of the Meter. This circle is divided into fractions so that small quantities of gasoline may be easily and accurately dispensed and recorded since the long sweep of the hand makes it possible to stop it at any desired sub-division of the circle.

To insure absolute accuracy, Meters are equipped with a special adjustment valve for correcting any slight variations that may develop from time to time, thus protecting not only the distributor but the purchaser as well.

For customers desiring alarm attachment the Meter is equipped with a bell. This rings with each complete revolution of the large black hand, indicating the delivery.

For installations located between two driveways, or in any position where gasoline may be dispensed from either side of the distribution equipment, the Meter is equipped with a double faced register as shown above.

An important feature of the Meter is that both hands may be instantly set back to zero after each sale. This is accomplished by a knob, located at the center of the dial easily accessible to the operator.

Whenever desired, the Meter is equipped with a set of price rings covering a suitable range of prices. These are removable and may be changed from time to time as the price of gasoline varies. When price rings are used the amount to be charged for each sale of even gallons shows through the window of the large red hand.

10 inch Single Dial Meter

Eureka V. P. Meter

The Eureka V. P. Gasoline Meter is made for use on the outlet of pumps having visible containers, to serve as a check against the pump to which it is attached.

The register is covered and protected by a lid which may be locked so that only authorized persons may have access to the reading of the meter. It is of the turbine type so designed and constructed that the piston is balanced and in perfect control. The Meter is equipped with needle valve adjustment, which is located at the top where it is easily accessible after the meter is installed, adjustment for accuracy should be made by the use of this needle valve and future adjustment, if necessary, made from time to time.

The meter may be installed either inside or outside the housing of any visible pump.

The oil meters illustrated are designed to accurately handle any type of service and have been found entirely satisfactory under practically all working conditions.

Only materials that will resist the possible deteriorating effects of oils of various grades are used. The outer cases of standard meters are made of bronze, while special meters for exceptionally high pressures and temperatures are equipped with special steel cases.

Pittsburgh Oil Meter

High Pressure Oil Meter

The interior working parts are of bronze, brass, monel metal, or other materials best suited to the work each part has to perform.

Unless otherwise specified registers are of the straight reading type indicating gallons, although other units of measurements can be provided.

These meters are given a very rigid test for accuracy during construction and before shipping and are furnished either with or without accuracy adjustment device, which makes possible maintained accuracy for an indefinite period of time and also permits correction for changes in viscosity.

PITTSBURGH EQUITABLE METER COMPANY

MAIN OFFICE AND WORKS PITTSBURGH, PA.

NEW YORK CHICAGO COLUMBIA, S.C. LOS ANGELES DALLAS TULSA SEATTLE KANSAS CITY SALT LAKE CITY

Standard Oil Stocks on New York Curb

1928 High	1928 Low	1929 High	1929 Low	Outstanding Capital	Par Value	Stocks	Div. Rate	Last Paid	Transactions Week Ended Oct. 26 Sales	First	High	Low	Last	Change
22⅜	14⅞	18¾	14¼	£4,126,460	£ 1	Anglo-American Oil	36c	June 5, 29	.....	.....	.....	.....	.....	.....
21¼	15	18	13	.....	....	do certificates	36c	June 5, 29	800	14¼	14½	14	14⅜	— ⅛
20½	14⅜	17	12¾	.....	£ 1	do cts. non-voting	36c	June 5, 29	400	13	13⅞	13	13	0
5	1¼	2½	1	(sh) 500,000	N.P.	Atlantic Lobos	.....	.....	100	1	1	1	1	0
9¾	3¼	4⅜	1	$10,000,000	$50	do pfd	.....	.....	.....	.....	.....	.....	.....	.....
56	44½	46½	25½	$1,000,000	25	Borne-Scrymser	$1S.A.	Oct. 15, 29	50	27½	27½	†25½	25½	— 2
76	58	74¼	65	10,000,000	50	Buckeye Pipe Line	‡$1Q	Sept. 14, 29	1,800	68	68	67	67	— ½
161	117¼	210	140⅛	3,000,000	25	Chesebrough Mfg	‡$1Q	Sept. 30, 29	650	175	179	161	161	—21½
23	16	29	16⅞	36,123,350	10	Continental Oil	.....	Dec. 15, 27	28,800	21½	21½	17⅜	18⅝	+ ⅝
17½	9½	11¾	7¼	.....	N.P.	Creole Petroleum	.....	.....	35,900	8⅝	8⅝	†7¼	7¾	0
82	67	95	60	1,500,000	50	Cumberland Pipe Line	$1Q	Sept. 16, 29	150	59¾	59¾	59¾	59¾	0
88	64⅛	70½	50	5,000,000	100	Eureka Pipe Line	$1Q	Nov. 1, 29	50	51	51	51	51	— 1
13	4¼	7	5	16,000,000	100	Galena Signal Oil	.....	June 30, 25	.....	.....	.....	.....	.....	.....
86	26	90	73½	4,000,000	100	do new pfd	.....	June 30, 26	.....	.....	.....	.....	.....	.....
89¾	35	88	73½	2,000,000	100	do old pfd	.....	June 30, 26	.....	.....	.....	.....	.....	.....
114¾	59¼	128	89⅝	73,685,700	25	Humble Oil & Refining	‡30cQ	Oct. 1, 29	15,800	116⅛	118⅞	107⅝	109	+ ⅝
290½	176½	340½	285	20,000,000	100	Illinois Pipe Line	$10S.A.	June 15, 29	1,950	300¼	302	295	295	— 4¼
104	56¾	41	26⅝	(sh) 26,421,768	N.P.	Imperial of Canada	12½cQ	Sept. 2, 29	10,100	35⅝	36	29⅞	34¼	— ¼
91⅞	74⅝	34⅞	26¾	$1,000,000	$10	Indiana Pipe Line	.....	.....	4,000	34¾	34¾	32⅛	32⅝	+ ⅛
55	35	29⅜	22⅛	(sh) 14,247,088	N.P.	International Petroleum	12½c	June 25, 29	11,300	27⅛	27⅞	†22⅛	25⅝	+ ⅛
32⅜	19⅜	25⅞	18¾	$6,363,350	12.50	National Transit Co	25cQ	Sept. 16, 29	4,200	20½	20⅝	†18¾	19	— 1
75	38½	85	72	1,000,000	10	New York Transit	40c	Oct. 15, 29	.....	.....	.....	.....	.....	.....
...	...	...	...	.....	....	do new	.....	.....	200	15¼	16¼	14⅞	14⅞	0
69	56½	63	50	2,000,000	50	Northern Pipe Line	$2S.A.	July 1, 29	100	50	54½	†50	50	— 1
83½	58½	79⅞	64⅛	60,000,000	25	Ohio Oil Co	50cQ	Sept. 14, 29	2,300	78	78	73⅞	75¾	+ ⅝
84	28	44½	23⅛	10,000,000	25	Penn Mex. Fuel	$1	Sept. 30, 29	500	25⅝	29⅝	23⅝	25	+ 1⅛
220	167	50	34⅝	4,000,000	25	Solar Refining	$1.25S.A.	June 20, 29	200	34⅝	34⅝	†34⅝	34⅝	— 2⅞
19	12	23½	13	1,000,000	10	Southern Pipe Line	$1	Mar. 1, 29	200	20⅜	22	20⅝	20⅝	— 1⅜
71⅞	36¾	60¼	40⅜	30,000,000	25	South Penn Oil	50cQ	Sept. 30, 29	2,400	47	47	44	45	+ 1
102	70	70	56	1,750,000	50	South West Pa. Pipe Lines	$1	Oct. 1, 29	100	60	63½	60	63½	+ 7½
95⅞	70⅞	63	51½	348,175,069	25	S. O. Indiana	62½cQ	Sept. 16, 29	139,400	55⅛	56	52	55⅞	— ⅛
27¾	15	33¾	18	8,000,000	25	S. O. Kansas	.....	June 16, 24	16,100	31¼	32	23⅝	28⅛	— 1⅞
49	44	46⅜	35½	25,654,516	10	S. O. Kentucky new	40cQ	Sept. 30, 29	29,800	43⅛	44½	36⅝	49¾	+ ½
54⅜	39⅞	50¼	45½	4,649,225	25	S. O. Nebraska	‡62½cQ	Sept. 20, 29	200	45½	47½	45½	45½	— 1½
134	71	129	75	14,000,000	25	S. O. Ohio	62½cQ	Oct. 1, 29	1,000	110	110	†75	98½	—11½
125	116	124½	113½	7,000,000	100	do pfd	$1.75Q	Sept. 3, 29	.....	.....	.....	.....	.....	.....
23½	16	18	10	861,466	25	Swan Finch	30c	Jan. 15, 29	150	10	10	†10	10	0
111	72	133¾	105½	126,154,000	25	Vacuum Oil	$1Q	Sept. 20, 29	13,800	118⅛	121½	109⅛	115¾	+ ¾

*New High †New Low ‡Also Extras

Independent Oils on New York Curb

1928 High	1928 Low	1929 High	1929 Low	Par Value	Stocks	Transactions Week Ended Oct. 26 Sales	First	High	Low	Last	Change
1½	.53	.72	.25	$5	Amer. Cons. Oilfields	18,000	1/16	¼	1/16	1/16	— 1/16
9½	3½	8⅝	2⅜	N.P.	Amer. Maracaibo	6,000	3⅛	3⅛	†2⅜	2½	— ⅛
4½	2¼	4⅜	1⅛	$10	Argo Oil	500	1⅜	1⅜	†1⅛	1⅛	— ⅜
3¾	3⅜	26	3¾	N.P.	Arkansas Nat. Gas	81,700	17½	19⅞	14⅛	15⅞	— 2⅞
....	....	24¾	6¾	N.P.	do A	179,900	18⅜	18½	11½	15¼	— 3⅞
55	32⅜	9	7⅞	10	do pfd	1,900	8⅜	8⅜	8¼	8⅜	0
23⅞	3¾	70	50	N.P.	British American Oil	.....	.....	.....	.....	.....	.....
.....	.....	4⅞	1⅜	25c	Carib Syndicate	5,400	2¼	2¼	†1¾	1⅞	— ⅜
.....	.....	68⅛	27¾	N.P.	Cities Service new	656,300	65¾	66	45	46¼	—20⅜
103½	94½	99¼	93	100	do pfd	1,500	94¾	94⅞	†93	93	— 1½
9⅝	8⅞	9¼	8⅞	10	do pref. B	.....	.....	.....	.....	.....	.....
97	88½	96	89¼	100	do pref. BB	.....	.....	.....	.....	.....	.....
2¼	1	1½	½	1	Colombia Syndicate	8,900	5/16	¾	5/16	5/16	— 1/16
17⅜	9⅜	15	6	N.P.	Colon Oil	9,600	9⅛	9⅜	7¼	8	— 1⅛
8⅞	6¼	11⅛	4¾	10	Consolidated Royal	600	4¾	4¾	†4¾	4⅞	0
....	....	135	45	N.P.	Cosden Oil Co	20,300	130	135	90¼	102⅜	—28¼
.....	.....	82	71	....	do pfd	400	80¼	80¼	80	80	+ 1¼
3¼	.76	2½	5/8	N.P.	Crown Central	.....	.....	.....	.....	.....	.....
15	6¾	11⅜	4	N.P.	Crystal Oil	.....	.....	.....	.....	.....	.....
50	48	51⅛	51⅛	$100	do pfd	.....	.....	.....	.....	.....	.....
33½	8⅛	26	10	N.P.	Darby Petroleum	20,700	11	12¼	10⅛	10⅞	— ⅜
2⅞	1	11	2	N.P.	Derby Oil & Refining	4,000	6⅞	7⅞	4	5¾	— 1¼
21⅛	7½	44	20⅞	N.P.	do pfd	.....	.....	.....	.....	.....	.....
165	101⅛	209	142⅛	$25	Gulf Oil Corp	55,600	185	186	158¾	165¼	—19⅝
7½	5⅝	7½	1⅛	5	Homaokla Oil	4,000	4	4	3	3⅝	— ⅜
3⅜	1	2⅞	⅝	10	Intercontinental Pet	40,100	1¼	1¼	†⅝	1⅛	— ⅛
3	¼	3⅝	1½	N.P.	Kirby Petroleum	3,100	2⅜	2⅜	2	2	— ½
9⅜	5⅛	6⅛	2	N.P.	Leonard Oil & Dev	9,000	3⅛	3¼	†2	2⅝	— 1
43⅜	20	38⅞	18	N.P.	Lion Oil & Refg	2,800	28½	28½	†18	24⅞	— 3¾
...	...	67⅞	32¼	N.P.	Lone Star Gas	16,700	52	54½	40	47	— 8
1⅞	.50	1¼	5/8	1	Magdalena Syndicate	2,600	½	½	3/8	3/8	0
48½	32	38½	17¾	N.P.	Margay Oil	1,400	19	19	†17¾	17¾	0
8	2¾	6⅝	2¾	N.P.	Mexico-Ohio Oil	800	3	3	3	3	0
.....	.....	42	15	N.P.	Missouri-Kan. P. L	18,600	30⅛	30⅞	†15	22	— 9⅝
1⅞	.76	1½	¾	1	Mountain & Gulf	3,900	¾	⅞	†¾	¾	— ⅛
28⅞	19½	22⅞	7	10	Mountain Producers	9,100	10¼	10¼	†7	9¾	— ½
.....	.....	43⅞	24¾	N.P.	Nat. Fuel Gas (new)	19,800	33	33	26⅛	32	— 2
5⅝	4¼	5	2½	5	New Bradford	1,000	2⅞	3	†2½	2⅞	— ⅛
5½	3	3⅞	3	10	New England Fuel	300	3	3	3	3	0
11⅞	7⅛	9⅜	3½	1	New Mex. & Ariz	500	4⅛	4¼	†3½	3½	— 1
15½	11½	24½	15⅛	25	New York Petrol	900	17	17⅝	†15⅛	15¾	0
13¼	8⅛	18½	8¾	N.P.	North Cent. Texas	500	11⅛	11¼	10½	11	— ¼
....	....	19¼	12	N.P.	Oil Stock, Ltd. A	1,100	13⅛	13⅜	†12	12¾	— ⅜
.....	.....	18¼	14	N.P.	do B	200	14⅜	14½	14⅜	14½	0
26¼	20	26⅝	14½	N.P.	Pacific Western Oil	.....	20⅜	20⅜	16⅛	17½	— 1⅞
6	2¼	3½	½	N.P.	Pandem Oil	12,900	5/8	5/8	1/16	1/16	— 1/16
15⅝	8½	10½	3⅞	N.P	Pantepec Oil	2,400	4¼	4⅞	4	4	— 1
20	10⅝	25½	22½	$25	Paragon Refg. B. ctfs.	.....	.....	.....	.....	.....	.....
.....	.....	34½	22⅜	N.P.	Petroleum Corp	14,900	26	26	†22⅜	23⅜	— 2¾
31⅜	26½	37	22	N.P.	Plymouth Oil	600	31⅛	31⅛	24⅝	26⅛	— 5
18	8	16	10	25	Red Bank Oil	1,600	15¼	15¼	14	15	+ 5
13	4⅛	8½	3⅛	N.P.	Reiter-Foster	2,300	3⅜	3½	3¼	3¼	— ¼
31½	23¼	25½	23	$25	Richfield pfd	200	23	23	†23	22¾	— 2⅛
.....	.....	29	23	....	Root Refining pfd	500	24½	24½	23½	23½	0
12	4⅜	11	5	N.P.	Ryan Consolidated	700	5½	5½	5	5	— 5/8
7¼	5½	5⅞	2	$10	Salt Creek Cons	200	2½	2½	2⅜	2⅜	— ⅛
35	23¼	25⅞	10⅜	10	Salt Creek Prod	900	12⅞	12⅞	†10⅛	11⅜	— 1
3½	1	2½	½	5	Savoy Oil	.....	.....	.....	.....	.....	.....
40	27	33⅛	32	25	Shreveport El Dorado	.....	.....	.....	.....	.....	.....
....	....	24	14	N.P.	Southland Royalty	4,300	14¾	15⅜	†14	14½	— ½
....	....	12	7¼	N.P.	Sunray Oil	1,200	8⅝	8⅝	†7¼	7	— 1⅝
....	....	23	12½	N.P.	Texon Oil & Land new	3,800	14½	14½	12⅝	12⅝	— 2⅜
22⅞	13	16⅞	11⅜	$10	Tidal Osage	.....	.....	.....	.....	.....	.....
21¼	13⅛	16½	10⅜	10	do not-voting	.....	.....	.....	.....	.....	.....
93¾	75	155	80	100	Transcontinental pfd	.....	.....	.....	.....	.....	.....
74¼	18	81⅛	66	10	Venezuela-Mexico	.....	.....	.....	.....	.....	.....
9⅛	4¾	6½	3	3	Venezuelan Petrol	7,200	3¼	3⅜	†3	3	— ⅜
.....	.....	72¼	66	N.P.	White Star Oil	.....	.....	.....	.....	.....	.....
8¼	4⅞	9⅛	4	1	Woodley Petroleum	400	4½	4¾	4½	4¼	— ⅜
⅜	⅛	5⅜	1	25	Y Oil & Gas	100	1⅛	1⅛	1⅛	1⅛	— ⅛

*New High †New Low

New York Curb Bonds

Week Ending Oct. 25

	High	Low	Last	Change
Beacon Oil 6s '36	118	117	117	—3
Cities Service 5s '66	87	84	84	—2⅛
Cities Serv. G. 5⅛s '42	90½	84⅞	86½	— ¼
Cities Serv. G. P. 6s '43	95	93	94⅛	+1
Cont. Oil 5¼s '37	94	93	93	—1
Empire O & R 5½s '42	86¾	84⅞	84⅞	—2⅛
Gulf Oil 5s '37	100	99½	100	+ ⅛
Gulf Oil 5s '47	100½	99⅝	99⅝	— ⅛
Indep. Oil 6s '39	104½	99⅛	102⅛	—1⅜
Shell Union Oil 5s '49	100⅜	100	100¼	+ ¼
Sun Oil 5½s '39	100¼	99⅝	100¼	+ ¼
Valvoline Oil 7s '37	102¾	102¾	102¾	— ¼

Oil Dividends

	Amount	Payable	Stock of Record
Skelly Oil q	50c	Dec. 15	Nov. 15
S. O. Ohio pfd. q	$1.75	Dec. 2	Nov. 8

New York Bonds

Week Ending Oct. 25

	High	Low	Last	Change
Assoc. Oil gold 6s	102	101¼	101½	— ¼
Atlantic Refg. deb. 5s	100½	100	100	— ⅛
Cal. Pet. 5s	95	94⅛	94⅞	+ ⅜
Cal. Pet. 5½s	99⅛	98⅜	99	+ ½
General Pet. 5s	99½	99⅜	99⅜	+ ⅜
Humble Oil & Refg. 5s	99¾	99¼	99¾	0
Humble Oil & Refg. 5½s	100⅜	99¾	99¾	— ¼
Pan Amer. P & T 7s	104½	104½	104½	0
Pan Amer. P & T 6s	107½	104½	105	+ ¾
Pan Amer. P & T 6s	98	96½	97	— ½
Phillips Pet. 5¼s	91	88	88	—1½
Pure Oil 5½s	99⅛	98⅛	98⅝	+ ⅛
Richfield Oil Calif. 6s	99⅜	98½	98½	—1
Shell Union Oil 5s	95	94	94½	+1
Simms Pet. 6s	100	100	100	0
Sinclair Con. Oil 7s	101⅜	100⅛	100⅝	—1⅛
Sinclair Con. Oil 6½s	100	99	99⅝	— ⅜
Sinclair Con. Oil 6s D	99¼	98¾	99	+ ⅛
Sinclair Con Crude 5½s	96	95	95⅞	+ ⅞
Sinclair Pipeline	93⅝	93	93⅛	+ ⅛
Skelly Oil 5½s	91	89	89	— ¼
S. O. N. J. 5½s	102	101	101½	— ¼
S. O. N. Y. 4½s	97¼	95½	95¾	+1¼
Union Oil of Calif. 6s A	106	105½	106	+ ½
Union Oil of Calif. 1st 5s C	100⅛	100⅛	100⅛	+⅛
Union Oil of Calif. 5s C	96¼	96	96	— ¼
Warner-Quinlan 6s	95	94	94	— ¼
White Eagle Oil 5½s	101½	100⅛	100⅛	—1⅛

(*Continued from Page* 363)

oil daily and has shut in production of about 15,000 barrels per day.

"Sales for the nine months amounted to $67,750,000, an increase in value of $4,850,000 over the same period last year. The quantity sold approximated 28,600,000 barrels in 1929, an increase of 3,800,000 barrels. Gasoline cargo shipments increased 58 per cent in volume over the first nine months of 1928.

"Capital outlay approximated $15,800,000, representing mainly expenditures for field development, additions and improvements to refining and marketing facilities, and the acquisition of prospective oil territory.

"Current assets, consisting of cash, United States government and other bonds, accounts and bills receivable, oil inventories and materials and supplies, at Sept. 30, 1929, approximated $67,800,000, an increase of about $11,000,000 over Dec. 31, 1928. The sale of capital stock, under the offering to stockholders of Dec. 20, 1928 added approximately $13,300,000 to the company's resources during the period. Current assets were over 7 to 1 of current liabilities at Sept. 30, 1929. The total quantity of oil in storage at Sept. 30, 1929 was about 34,000,000 barrels.

"Current liabilities at Sept. 30 were about $9,600,000, a decrease of $1,866,000 from Dec. 31, 1928. During the nine months bonded indebtedness decreased $2,246,000, the total indebtedness decreasing $4,112,000."

Royal Dutch Will Vote On Capital Increase

CLEVELAND, Oct. 25.—An extraordinary meeting of stockholders of the Royal Dutch Co. has been called for Nov. 6 to vote on a proposal to increase the capital from 600,000,000 to 1,000,000,000 guilders, according to cable advices from Amsterdam to New York. It also was reported that a bond issue had been authorized but no offering would be make at present.

The present capital of the Royal Dutch Co. is divided into 570,000,000 guilders of ordinary shares of 1000 guilders par value each, 28,300,000 guilders of 4½ per cent priority shares and 1,500,000 guilders of 4 per cent preference shares.

For convenience of trading each ordinary share is divided into 10 sub-shares of 100 par value each. The New York shares are equivalent to one-third a sub-share. The sub-shares in American money have a par value of $40.20 each.

Approximately 495,643,000 of the authorized 570,000,000 guilders of ordinary shares are outstanding.

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Positions Wanted

SALESMAN AND SALES EXECUTIVE desires new connection. Fifteen Years Experience, Pioneering and Directing Sales of Pennsylvania and Mid-Continent Motor Oils in the South. Well acquainted with Southeastern Jobbing Trade. Born and Raised in Pennsylvania Oil Fields. Age Thirty-Eight. College Education. Married. Past Record clean and successful. Address Post Office Box 572, Jacksonville, Florida.

EXECUTIVE

Now employed by large petroleum marketer in executive position, desires change in middle west territory. Well versed in all lines of distribution, costs, sales, operation of bulk and service stations and handling of personnel. Age 33, married, energetic, willing to assume responsibility, with best of references.

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CHEMIST OR CHEMICAL ENGINEER WANTED

Must have experience in the manufacture of grease. In reply give complete details of personal history, education, experience, etc. Send kodak picture of yourself.

Address Box 442, care of National Petroleum News.

EXECUTIVE

To take complete charge of purchasing and distribution of gasoline and petroleum products for large chain store operation, national in scope. Only men of highest executive calibre and established records considered.

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CHEMICAL ENGINEER WANTED

for process design of oil refinery equipment, including pipe still furnaces, treating plant, general fractionating equipment, et cetera.

Man with at least three years' process experience in oil refinery, having worked preferably on design or test work. Age 25 to 38. Good salary. Location, Elizabeth, N. J.

Apply Standard Oil Company of New Jersey, 26 Broadway, New York City, Room 943.

Advertisers having box numbers should be addressed in care of National Petroleum News, 1213 West 3rd Street, Cleveland, Ohio, unless otherwise specified.

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REWARD

for information in regard to Lee Smith, salesman formerly with the Allied Grease & Oil Company, Chicago. Mr. Smith drives a tan 1927-70 Chrysler Coach, Minnesota license No. B34577, Serial number on dash board No. PS2635. Write or wire at my expense.

Address A. Zekman, 1408 Hennepin Ave., Minneapolis, Minnesota.

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